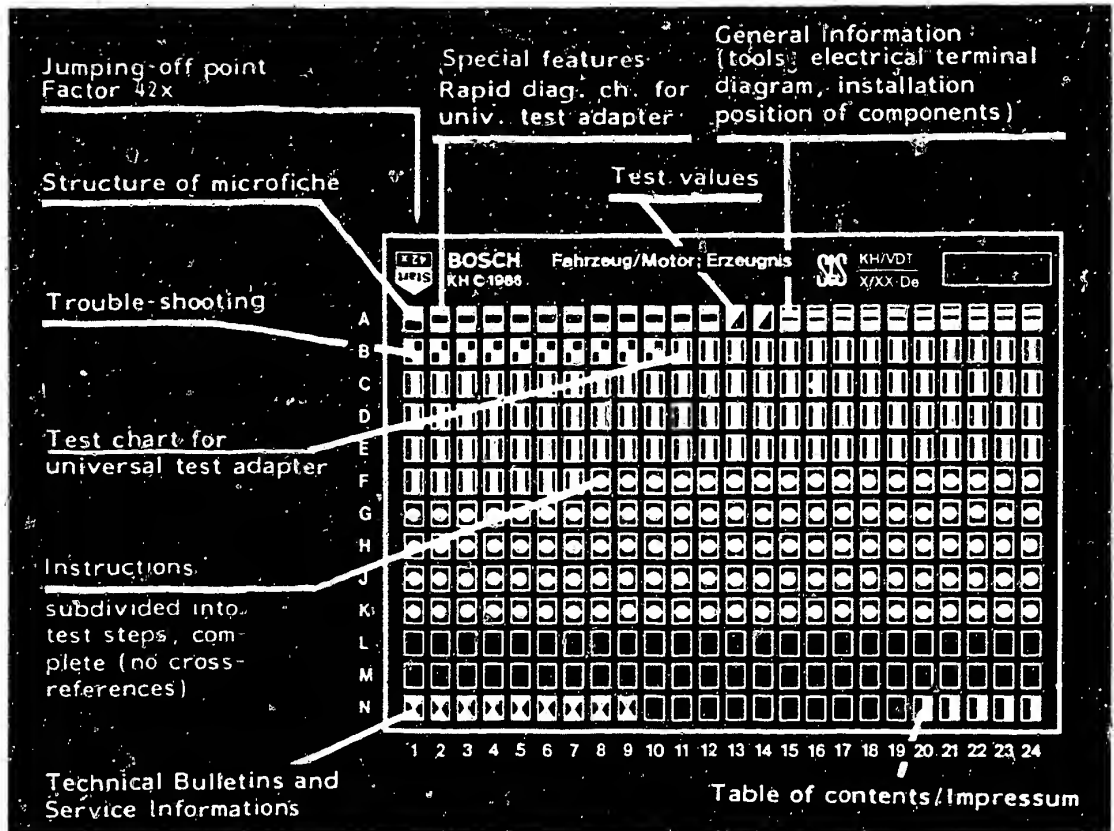


## Structure of microfiche



1. Read from left to right
2. Title of microfiche (appears on each coordinate)

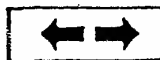
<b>E16</b>	Product/component/test step
	Vehicle/engine

Coordinate

3. Limits of section



Beginning



Mid-section



End



One-page section

4. Purely vehicle-specific passages in the text are marked with a vertical bar.

5. Reference to relevant working steps in the test specifications, e.g. coordinate C6.

**C6**

**A1**

Trouble-shooting program



This microcard contains the trouble-shooting instructions for Motronic in the following BMW models valid at the time of writing:

- BMW 635 CSi and 735i (9.83 → 9.84)
- BMW 732i (9.83 →)
- BMW 745i Turbo (5.83 →)

#### SPECIAL FEATURES

The Motronic control unit forms a functional unit with the electronic transmission control (Motronic and electronic transmission control integrated in one control unit (2 x 35-pin plug)).

#### Deviations from the Europe version:

- Sweden/Switzerland version (S/CH) from 9.84 has different CO concentrations at idle speed.
- Deviations in the Japan version:
  - Ignition map
  - CO concentration and idle speed
  - Emission-control system (catalytic converter without Lambda control)

#### 1. RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER

The following rapid diagnosis chart enables the experienced Motronic specialist to quickly test the electrical parts of the system using the universal test adapter.

The rapid diagnosis chart contains the following information:











- Test-step sequence
- V and  $\Omega$  program switch positions.
- Remarks on the operation of the universal test adapter and other components.
- Test specifications for motortester and multimeter
- The coordinates for the respective detailed testing and trouble-shooting programs.

If detailed information and instructions are necessary, always proceed per the trouble-shooting charts starting with Coordinate C1.



# Rapid diagnosis chart for universal test adapter

Applies to control units nos. 261 200 013, ... 018, ... 019, ... 024, ... 025

Test step	Switch position		Remarks	Test specifications (reading)	For trouble-shooting see
	V	$\Omega$			Coordinates
1		1	Shift gear to neutral, ignition off. Disconnect control unit and pump relay. Measure insulation resistance of engine-speed sensor. Term. 8 against term. 5.	Greater than 1 M $\Omega$	B 18
2		2	Measure insulation resistance of reference-mark sensor. Term. 25 against term. 5.	Greater than 1 M $\Omega$	B 20
3		3	Measure winding resistance of engine-speed sensor. Term. 8 against term. 27.	0.6...1.6 k $\Omega$	B 22
4		4	Measure winding resistance of reference-mark sensor. Term. 25 against term. 26.	0.6...1.6 k $\Omega$	C 1
5		5	Measure resistance of engine temperature sensor (NTC II). Term. 13 against term. 5.	At 15° to 30° C: 1.45...3.3 k $\Omega$ (depends on temp.)	C 5
6		6	Measure resistance of air temperature sensor (NTC I). Term. 22 against term. 5.	At 15° to 30° C: 1.45...3.3 k $\Omega$ (depends on temp.)	C 7
7/8		7/8	Deleted	-----	-----
9		9	Accelerator in rest position. Measure resistance of idle contact. Term. 2 against term. 5	Less than 10 $\Omega$	C 9
10		10	Fully depress accelerator pedal. Measure resistance of full-load contact, term. 3 to term. 5 or full-load enrichment via knock-control unit. Measure resistance of knock-control unit (745i). Terminal 3 to terminal 5 on Motronic control unit. (Do not press accelerator pedal).	Less than 10 $\Omega$ 745i: 1 ... 9 k $\Omega$	C 13
11		11	Measure resistance. Ground term. 16 against term. 5.	Less than 10 $\Omega$	C 15

**A3**

Rapid diagn. chart for univ. test adapt.  
BMW 6 and 7 series with elec. trans.



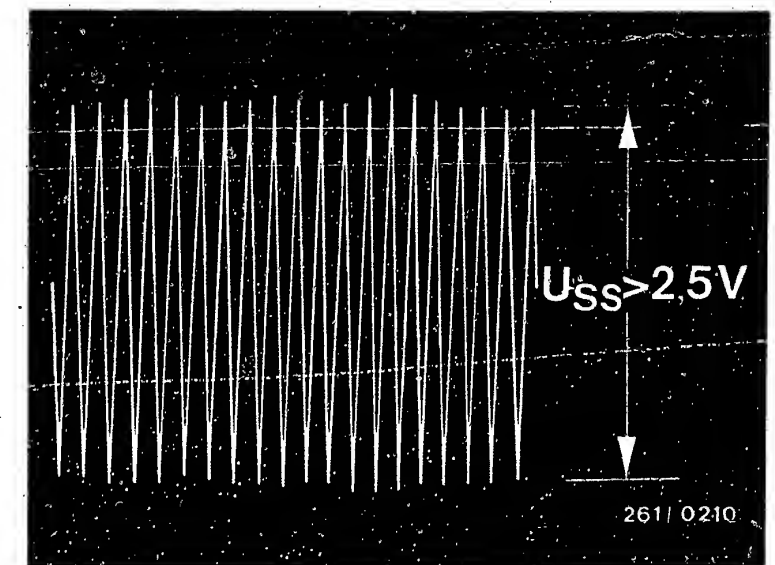
**A4**

Rapid diagn. chart for univ. test adapt.  
BMW 6 and 7 series with elec. trans.



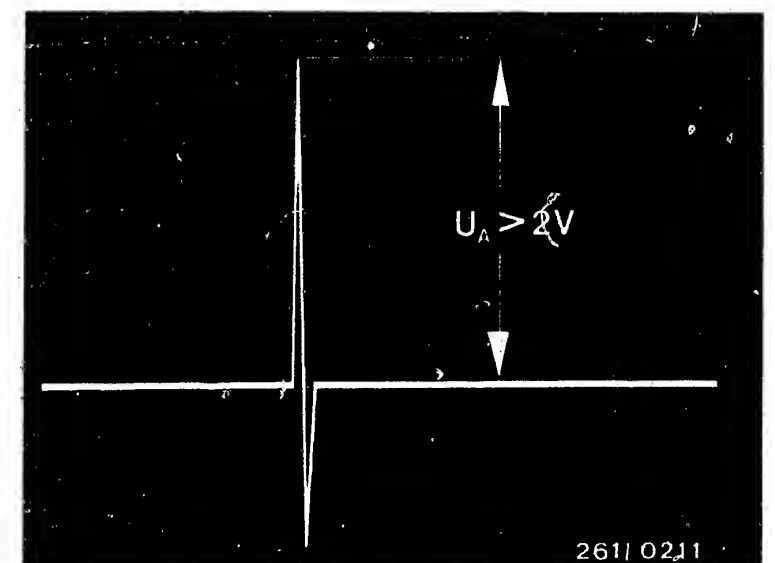
# Rapid diagnosis chart for universal test adapter (continued)

Test	Switch		Remarks	Test specifications (reading)	Trouble-shooting, see coordinates
	V	$\Omega$			
12		12	Measure resistance. Ground term. 17 to term. 5	Less than 10 $\Omega$	C 17
13		13	Measure resistance. Ground term. 19 to term. 5	Less than 10 $\Omega$	C 19
14	↓	14	If present, measure resistance of altitude sensor (pressure sensor). Term. 30 to term. 5	0.4 ... 2.3 k $\Omega$ Height-dependent	C 21
15	↓	14	Careful! If present, measure voltage of altitude sensor (pressure sensor) at the $\Omega$ sockets! Test specifications are height- and battery-voltage-dependent! Battery voltage between 10 and 14 V. Measure at term. 30 and term. 5. Switch on ignition.	0 m: 1.5 ... 3.5 V 500 m: 2.5 ... 5 V 1000 m: 3.5 ... 6 V 1500 m: 4.5 ... 7.5 V	C 23
16	1	15	Check signal with oscilloscope. Engine-speed sensor term. 8 to term. 27. Disengage gear and start.	See upper illustration	D 1
17	2	15	Measure signal with oscilloscope at reference-mark sensor term. 25 to term. 26. Disengage gear and start.	See lower illustration	D 5
18/19	3/4	15	N/A	---	---
20	6	15	Measure voltage at main relay term. 35 to term. 5	10 ... 15 V	D 9
21	7	15	Measure voltage at main relay term. 18 to term. 5	10 ... 15 V	D 11



Engine-speed sensor signal

Reference-mark sensor signal



**A5**

Rapid diagn. chart for univ. test adapt.  
BMW 6 and 7 series with elec. trans.



**A6**

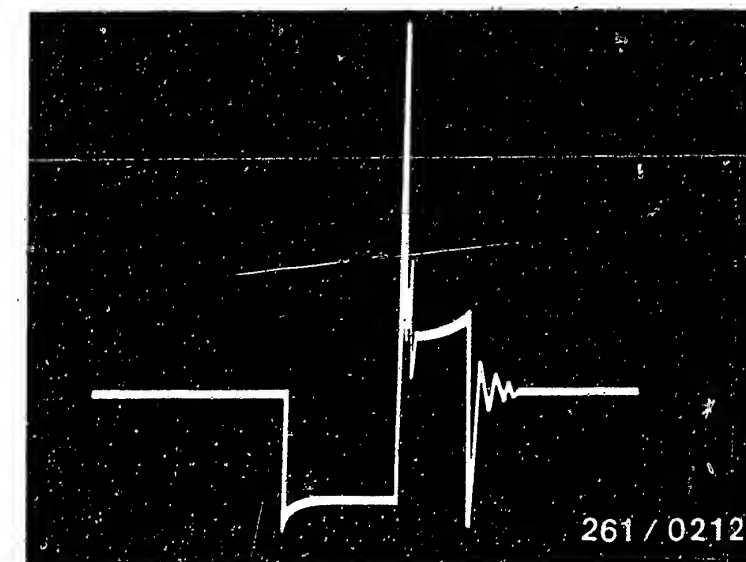
Rapid diagn. chart for univ. test adapt.  
BMW 6 and 7 series with elec. trans.



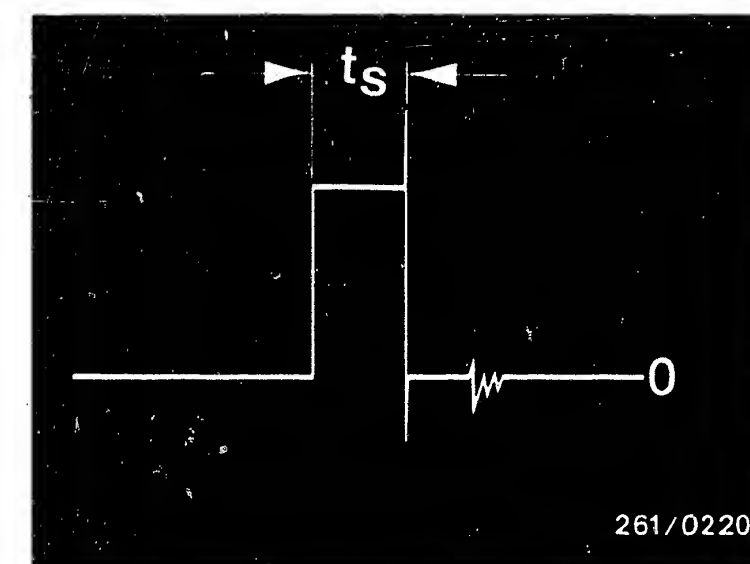


# Rapid diagnosis chart for universal test adapter (continued)

Test Step	Switch position		Key	Remarks	Test specifications (reading)	Trouble-shooting, see coordinates
	V	$\Omega$				
22	5	15		Ignition off. Connect control unit for Motronic.  Ignition on. Measure ignition symbol with oscilloscope. Disengage gear and start. Control unit, ignition stage term. 1 to term. 5. Evaluation: signal present.		F 1
23	8	15		Measure voltage at control unit term. 9 to term. 5	Greater than 8 V	D 15
24	9	15		Measure voltage at air-flow sensor term. 7 to term. 5.  Sensor flap at rest:  Sensor plate opened to stop	150 ... 250 mV  Greater than 7 V	D 17
25/26	19/11	15		N/A	----	----
27	12	15		Measure voltage. Start signal term. 50. Term. 4 to term. 5.	8 ... 15 V	D 19
28	13	15		Measure control unit dwell period $t_s$ with oscilloscope, term. 21 to term. 5. Disengage gear and start	See lower illustration	D 21

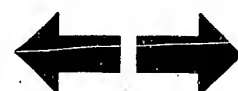


$t_s$  = Dwell period  
0 = Zero line



**A7**

Rapid diagn. chart for univ. test adapt.  
BMW 6 and 7 series with elec. trans.



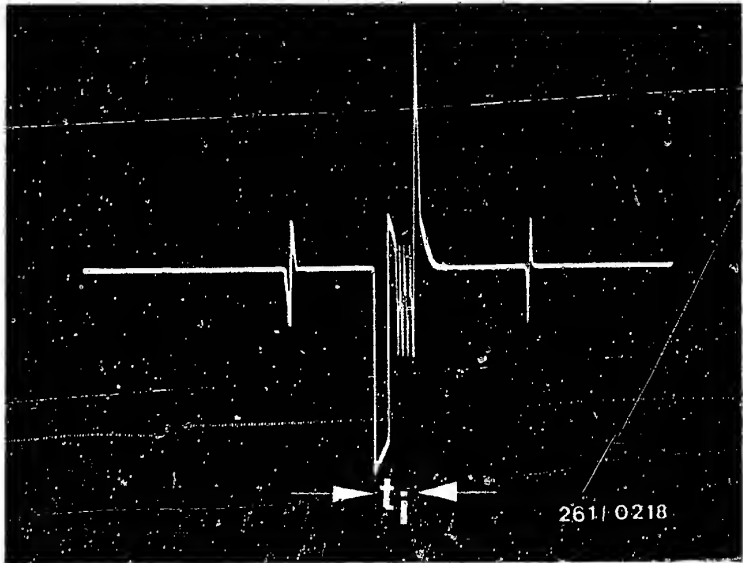
**A8**

Rapid diagn. chart for univ. test adapt.  
BMW 6 and 7 series with elec. trans.

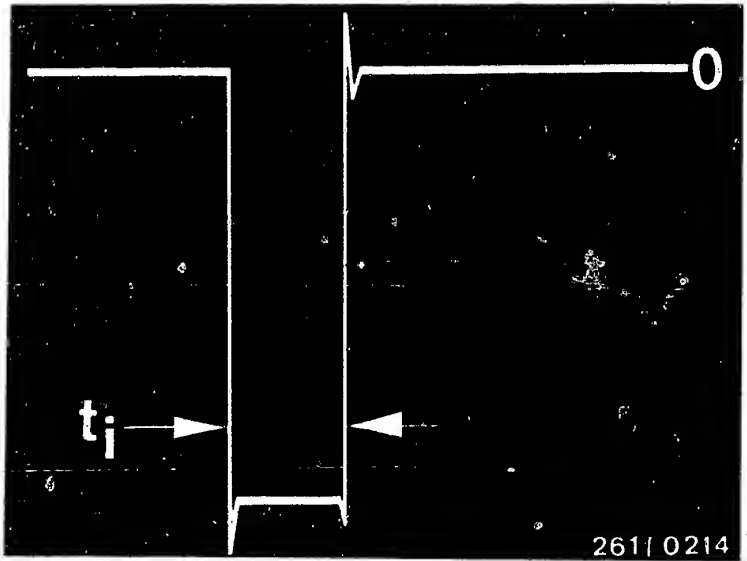


Rapid diagnosis chart for universal test adapter (continued)

Test Step	Switch position		Key	Remarks	Test specifications (reading)	Trouble-shooting, see coordinates
	V	$\Omega$				
29	14	15		Check injection signal $t_i$ from control unit with oscilloscope. Term. 14 to term. 5. Disengage gear and start.		D 23
30	14	15	T1	As 29, except after pressing key (NTC II, cold) injection time becomes somewhat longer	See upper illustration	E 1
31	15	15		As 29, except test term. 15 to term. 5.		E 3
32	16	15		Test injection time $t_i$ from control unit with oscilloscope, term. 11 to term. 5. Disengage gear and start.	See lower illustration	E 5



$t_i$  = Injection signal



# Rapid diagnosis chart for universal test adapter (continued)

Test step	Switch position		Key	Remarks	Test specifications (reading)	Trouble-shooting, see coordinates
	V	$\Omega$				
33	17	15		Plug in pump relay. Switch on ignition. Measure voltage at pump relay term. 20 to term. 5.	10 ... 15 V	E 7
34	17	15		Measure voltage. Disengage gear and start. Control unit, pump control active. Term. 20 to term. 5	max. 4 V	E 9
35	21	15		Measure knock-control unit dwell-period signal $t_s$ with oscilloscope (only 745i). Term. 24 to term. 5. Disengage gear and start.	Positive rectangular signal	E 11
36	17	15	T3	Ignition off. Connect pressure guage. Ignition "ON". Press key T3, read off fuel pressure.	2.8 ... 3.2 bar 745i: 2.3 ... 2.7 bar	E 13
37	17	15		Connect motortester. Connect CO tester. Run engine. Check idle speed and CO.	750 ... 850 min <sup>-1</sup> J: 800 ... 900 min <sup>-1</sup> 1.0 ... 1.5 vol. %CO S/CH: 0.6...1.0 vol. %CO J: 0.45 ... 0.65 vol. %CO	E 19
	17	15	T2	As above, specifications unchanged!	(for J: measurement before cat. converter)	
38	17	15		Allow engine to run. Check spark advance at idle speed. Important! Idle speed must be between 750 ... 850 / 800 ... 900 min <sup>-1</sup> , as otherwise other spark advances will be shown!	7° ... 17° J: 2° ... 12°	E 23
	17	15	T6	Check spark advance at full load. Set idle speed to 2400 min <sup>-1</sup> and T6 (full-load key).	13°...23° at 2400 min <sup>-1</sup> J: 7°...17° at 2400 min <sup>-1</sup>	E 23
39	17	15		Dwell angle at idle speed	8° ... 15°	F 1
				Dwell angle at 2400 min <sup>-1</sup>	22° ... 42°	
40	17	15	T5	Keep constant engine speed of 2000 min <sup>-1</sup> . Press key T5. Injection signals go out and come back on again at approx. 1200 min <sup>-1</sup> .	Engine "surges"	F 3
41	↓	10		Careful! Voltage measurement in $\Omega$ sockets! Reading at engine idle approx. 4.5 V. After short snap acceleration up to full-load start, reading briefly goes under 4.5 V.		F 5

**A11**

Rapid diagn. chart for univ. test adapt.  
BMW 6 and 7 series with elec. trans.



**A12**

Rapid diagn. chart for univ. test adapt.  
BMW 6 and 7 series with elec. trans.



## 2. TEST SPECIFICATIONS

### Idle speed

Japan: 750...850 min<sup>-1</sup>  
800...900 min<sup>-1</sup>

**B7**

Exhaust-gas setting  
CO concentration with  
engine at operating  
temperature:

S/CH: 1.0...1.5 vol. %CO  
0.6...1.0 vol. %CO  
Japan: 0.45...0.65 vol. %CO  
(Measurement before  
cat. conv.)

### Fuel pressure

745i 2.8...3.2 bar  
2.3...2.7 bar  
min. 1050 cm<sup>3</sup>/30s  
min. 1150 cm<sup>3</sup>/30s

Fuel pump delivery:  
Pre-supply pump:

See equipment and autodata microcards for settings for  
ignition, valve play, and other engine data.

Solenoid-operated injection valve  
Electrical internal  
resistance:

2 ... 3 Ω

### Air-flow sensor

Resistance between term. 7  
and term. 6:

8 Ω...2500 Ω  
(Deflect sensor flap)

Term. 9 and term. 6:

500 Ω...1100 Ω

Auxiliary-air device  
Electrical internal  
resistance

30 ... 65 Ω

**A5**

**A13**

Test specifications

BMW 6 and 7 series with elec. trans.



Temperature sensor I (NTC I air):

Electrical internal resistance

at + 15° C...+30°C: 1.45...3.3 kΩ

measured at air-flow

sensor between terminals

22 and 6 at +80°C: 280...360 Ω

**B 7**

Temperature sensor II (NTC II coolant):

Electrical internal resistance

at + 15°C...+30°C: 1,3...3,6 kΩ

at + 80°C: 250...390 Ω

Engine-speed sensor and reference-mark sensor

Electrical internal

resistance 0.6...1.6 kΩ

**B9**

Throttle-valve switch

Resistance of idle

contacts (terminals 2 and  
43):

0 Ω

Full-load contacts

(terminals 3)

(knock control unit)

**B 7**

Start valve

Electrical internal resistance approx. 4 Ω

Thermo-time switch

Electrical internal resistance:

	"G" and ground	"W" and ground	"G" and "W"
Ambient temp. (below +30°C):	25...40 Ω	0 Ω	25...40 Ω
at normal op. temp. (above +40°C):	50...80 Ω	100...160 Ω	50...80 Ω

Pressure sensor (altitude sensor)

Total resistance between

Term. 3 (+) and term. 2 (-): 2.3...2.5 kΩ

Resistance between wiper

Term. 1 (S) and term. 2 (-): 0.4...2.3 kΩ  
(depends on altitude)

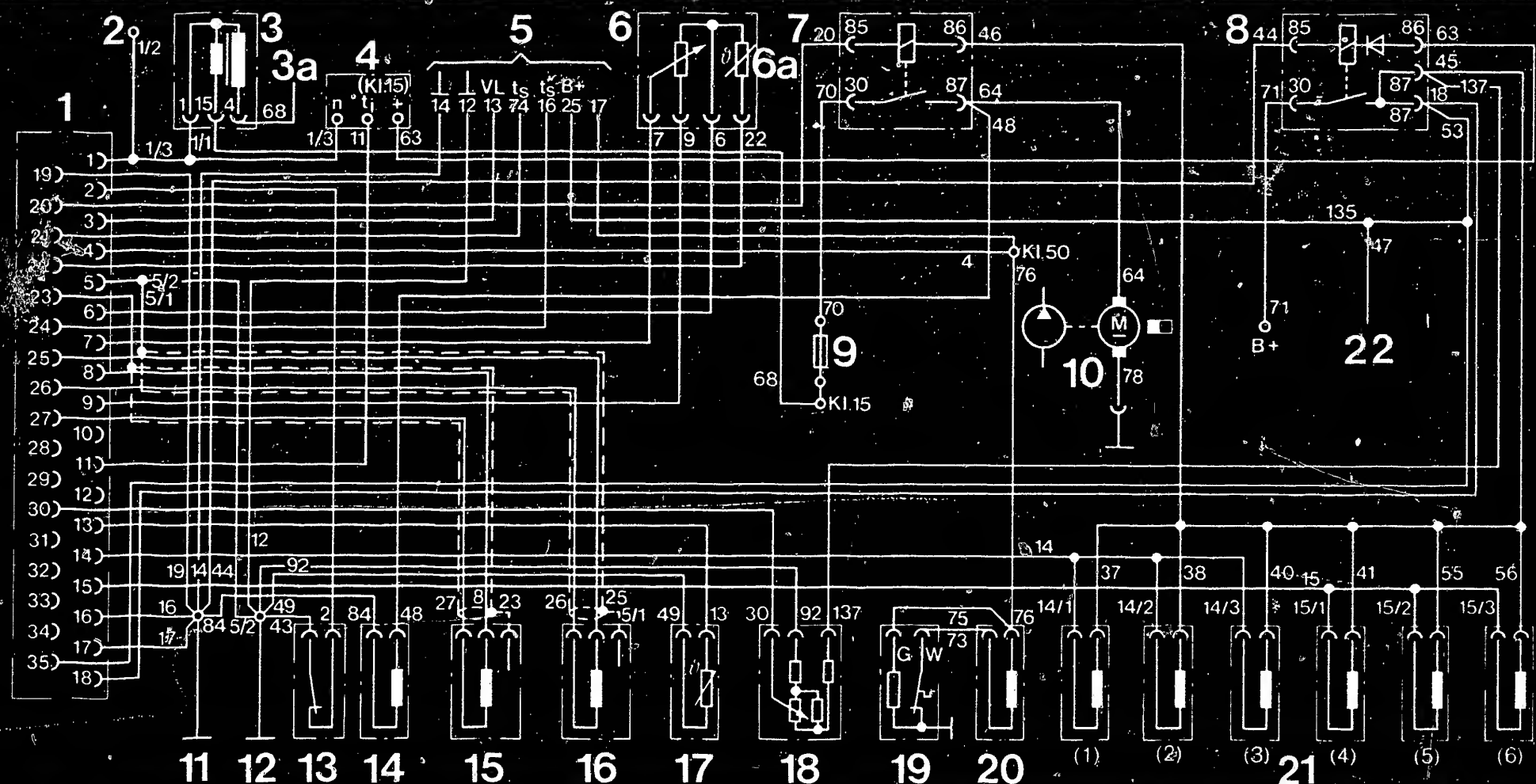
**B9**

**A14**

Test specifications

BMW 6 and 7 series with elec. trans.





### 3. ELECTRICAL TERMINAL DIAGRAM

- 1 = Control unit plug
- 2 = To diagnostic plug and tachometer
- 3 = Ignition coil
- 3a = To high-voltage distributor
- 4 = Plug to on-board computer
- 5 = Leads to knock-control unit (745i)
- 6 = Air-flow sensor
- 7 = Relay 1 (pump relay)
- 8 = Relay 2 (main relay with reversed-polarity protection diode)

- 9 = Pump fuse
- 10 = Fuel pump
- 11 = Vehicle ground for control unit output stage
- 12 = Vehicle ground for control unit
- 13 = Throttle-valve switch (2 = idle contact, 3 = full-load contact)  
In 745i no full-load contact, instead full-load enrichment via knock-control unit term. 13
- 14 = Auxiliary-air device
- 15 = Engine-speed sensor
- 16 = Reference-mark sensor

- 17 = Temperature sensor II (coolant)
- 18 = Altitude sensor (pressure sensor, (745i))
- 19 = Thermo-time switch
- 20 = Start valve
- 21 = Injection valves
- 22 = To transmission relay term. 30

**A15**

Electrical terminal diagram

BMW 6 and 7 series with elec. trans.

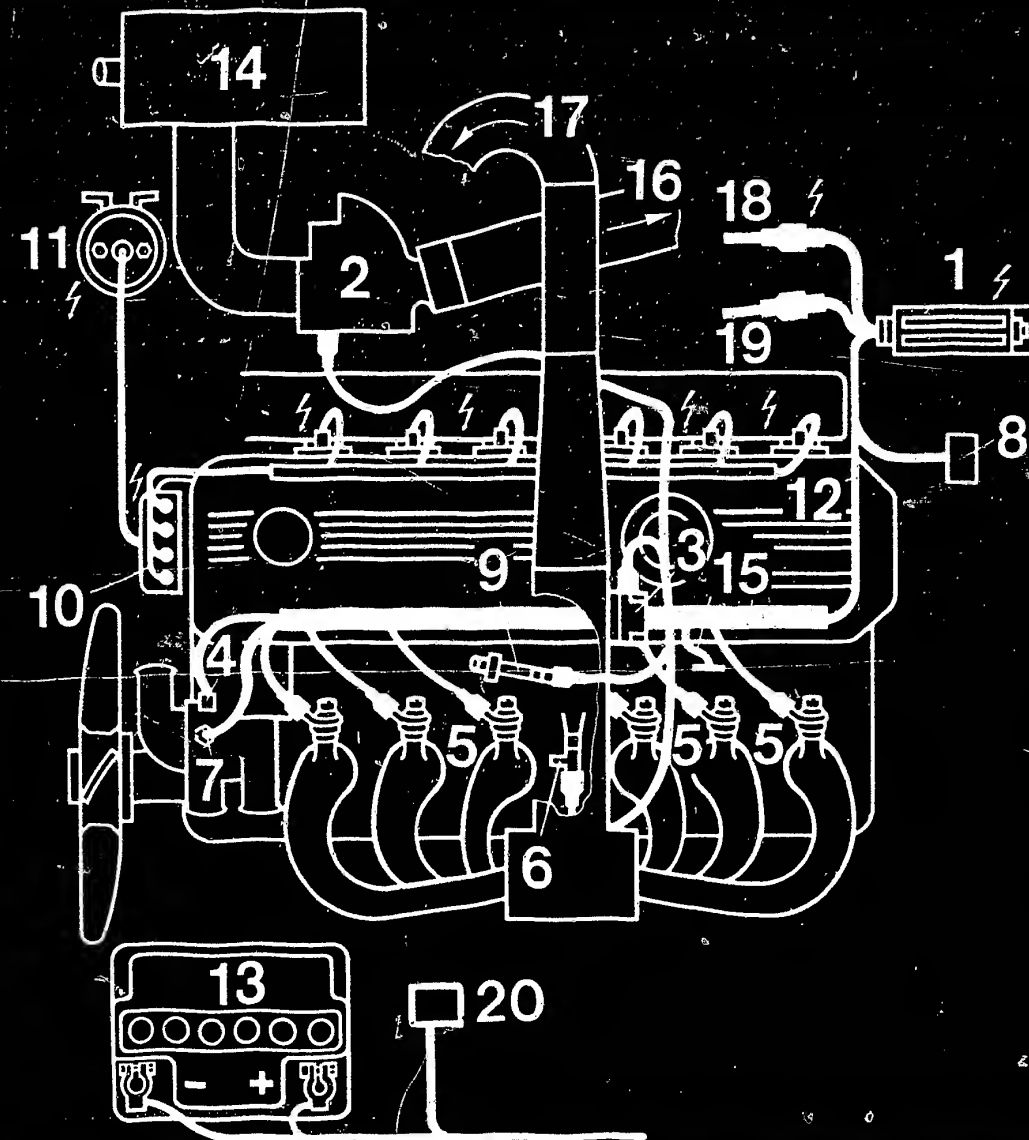


**A16**

Electrical terminal diagram

BMW 6 and 7 series with elec. trans.





261/0076

### 3.1 Electrical wiring diagram of Motronic and arrangement of individual components (745i Turbo):

- |                                 |                               |   |  |
|---------------------------------|-------------------------------|---|--|
| 1 = Control unit                | 8 = Main relay                | 14 = Air filter                             | 19 = 3-pin plug connector to on-board computer |
| 2 = Air-flow sensor             | 9 = Auxiliary-air device      | 15 = Central ground                         | 20 = Pump relay                                |
| 3 = Throttle-valve switch       | 10 = High-voltage distributor | 16 = To turbocharger                        |  |
| 4 = Temperature sensor (NTC II) | 11 = Ignition coil            | 17 = To charge-air cooler                   |  |
| 5 = Injection valves            | 12 = Motronic wiring harness  | 18 = Lead to tachometer and diagnostic plug |  |
| 6 = Start valve                 | 13 = Battery                  |   |  |
| 7 = Thermo-time switch          |                               |   |  |
- ⚡ = Dangerous secondary and primary voltages

**A17**

Electrical wiring diagram

BMW 6 and 7 series with elec. trans.



**A18**

Electrical wiring diagram

BMW 6 and 7 series with elec. trans.





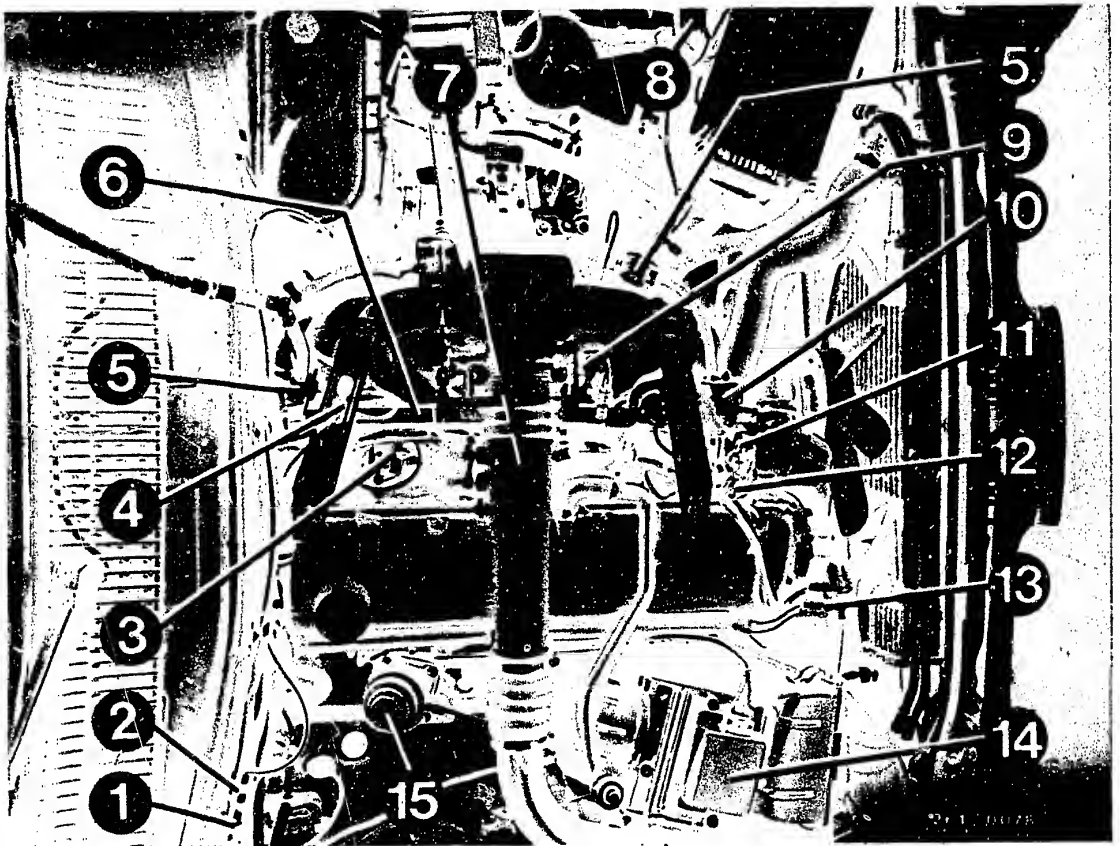
#### 4. Test equipment and tools

<u>Description</u>	<u>Designation</u>	<u>Part No.</u>
Universal test adapter Adapter cable	ETT 018.01	0 684 101 801 1 684 463 124
Motortester	e.g. MOT 002.00 or 200	0 684 000 200
Calibrated infrared exhaust tester	e.g. ETT 008.04 or ETT 008.05	0 684 100 804 0 684 100 805
Multimeter (analog reading, internal resistance min. 20 k $\Omega$ /V		Commercially available e.g. type MA 2H from Metrawatt or Chinaglia, Cortina model
Pressure gauge 6 bar  or Pressure tester or Pressure tester (no longer available)	Quality class 1.0 0.1 bar graduations	1 687 231 154  KDJE-P 100 KDEP 1034
Three-way line as connection piece for KDJE-P100 and KDEP 1034		KDJE-P100/13



<u>Description</u>	<u>Part No.</u>
Feeler gauge for measuring the sensor air gaps (up to 1 mm)	Commercially available
Lubricant for engine-speed and reference- mark sensors	Molykote Longterm 2, commercially available
Chassis dynamometer e.g. LPS 96 or LPS 002	0 680 017 001 0 680 100 200
Test lead 2-pin, for measuring resistances and signals e.g. at injection valves	1 684 463 093





#### 5. Installation position of components (745i-Turbo)

- |  |                                     |
|--|-------------------------------------|
| 1 = Main relay                             | 9 = Microswitch (idle contact)      |
| 2 = Altitude sensor (pressure sensor)      | 10 = Pressure regulator             |
| 3 = Injection valves                       | 11 = Thermo-time switch             |
| 4 = Engine-speed and reference-mark sensor | 12 = Temperature sensor II (engine) |
| 5 = 2 fuel-line-pressure dampers           | 13 = High-voltage distributor       |
| 6 = Fuel-distribution pipe                 | 14 = Air-flow sensor                |
| 7 = Start valve                            | 15 = Bypass valve                   |
| 8 = Pump relay                             |                                     |



## Installation position of components (continued)

The indications "right" and "left" refer always to the forward direction of travel. Listed below are components which are not visible in the picture.

Reference-mark and engine-speed sensor:

In starting-motor ring-gear housing at circumference of flywheel ring gear.

Pressure sensor:

On firewall on right in engine compartment

Fuel filter and fuel pump:

Underneath vehicle on left, near fuel tank.

Pre-supply pump:

Underneath mat in luggage compartment.

Ground lead of electric fuel pump:

Underneath rear seat bench, on left (recess), ground point on body.

Control unit:

Behind side panel in right-hand footwell.

Central ground:

Below plug connectors for engine-speed and reference-mark sensors.

Auxiliary-air device:

Underneath throttle-valve assembly.



## 6. Important general information

This information must be observed in order to prevent damage to the engine, control unit or ignition coil and for the safety of personnel.

1. Never start engine without securely connected battery.
2. Incorrect polarity of the supply voltage, e.g. by incorrect connection of the battery or ignition coil, can lead to irreparable damage to the control unit.
3. Do not use a fast charger for starting the engine.

Use only a second 12 V battery and jump leads.

Caution! Owing to different requirements of vehicle manufacturers with regard to electronic products we advise you not to use 24 V batteries as an aid for starting. Follow the vehicle owners manual.

4. Disconnect the battery from the vehicle electrical system before fast charging.
5. When charging the battery in the vehicle or when using a starting aid, follow operating instructions of fast charger and note vehicle manufacturer's instructions.
6. Never disconnect the battery from the vehicle electrical system with the engine running.
7. Do not short-circuit ignition coil term. 1 to ground (e.g. for stopping the engine). The ignition coil and possibly the control unit will suffer irreparable damage.
8. Never bring the positive pole of the battery into contact with ignition coil term. 1. The control unit will suffer irreparable damage.



9. Never connect or disconnect the wiring-harness plug of the control unit with the ignition switched on.
10. Remove the control unit at temperatures above 80°C (paint-drying installation).
11. Remove the control unit before performing welding work (electric spot welding).
12. Remove the relay combination when performing a compression test. This prevents undesired injecting of the injection valves.
13. When installing an alarm system, follow the information given in the installation instructions for Motronic vehicles or follow technical bulletin ALL 500.

It must be ensured that the alarm relay does not suffer interference from stray fields (e.g. from H.T. ignition cables), causing it to trip incorrectly.

14.

CAUTION!

High-energy ignition system.  
Dangerous primary and secondary voltages.



Contact with live parts or terminals can be extremely hazardous (on both the primary and secondary sides).



## 7. Trouble-shooting

The following trouble-shooting programs are designed to enable the workshop employees using the Universal test adapter and other suitable testers to quickly detect causes of trouble on the Motronic.

Depending on the level of training and experience of the mechanic a choice can be made between the following procedures:

- Detailed, step-by-step trouble-shooting for employees with little experience or practice on Motronic vehicles.
- Pin-pointed direct trouble-shooting for trained and experienced employees who have a great deal of practice on Motronic vehicles.

**B3****B5**

Both trouble-shooting programs start by checking the electrical/electronic part of the Motronic using the Motronic test adapter ETT 018.01. This makes it possible within a short space of time to check the electrical operation of the wiring harness with the connected components (including control unit) and to quickly locate faults.

If no fault is found using the Motronic test adapter, it is necessary to continue with the detailed or the direct trouble-shooting program.

**B1**

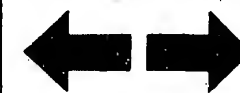
Trouble-shooting

BMW 6 and 7 series with elec. trans.

**B2**

Trouble-shooting

BMW 6 and 7 series with elec. trans.





## 7.1 Detailed, step-by-step trouble-shooting

### 7.1.1 Test with Motronic test adapter

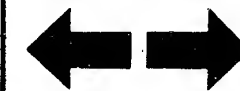
This test must come at the start of the test program and must be performed from beginning to end.

### 7.1.2 Trouble-shooting according to customer complaints (fault symptoms)

The table below contains possible fault symptoms and the right-hand column gives the first coordinate of the respective detailed trouble-shooting program.

The trouble-shooting program consists of logically ordered test steps for all individual components of the Motronic. If, after completing the trouble-shooting program for an assumed symptom, the fault has not been located or remedied, choose a new fault symptom and work through the respective program.

<u>Customer complaints (fault symptom)</u>	<u>Test with test adapter</u>	<u>Coordinates</u>
1. Engine fails to start or starts only with great difficulty	B 11	F 8
2. Engine starts but then dies	B 11	G 5
3. Uneven engine idle	B 11	G 17
4. Poor throttle take-up	B 11	H 13
5. Engine missing under all operating conditions	B 11	J 3
6. Fuel consumption too high	B 11	J 17
7. No maximum engine power	B 11	K 1
8. CO concentration at idle too high or too low	B 11	K 15



## 7.2 Pin-pointed, direct trouble-shooting

### 7.2.1 Test with universal test adapter

The test with the test adapter must come at the start of the test program and must be performed from beginning to end.

### 7.2.2 Trouble-shooting according to customer complaints

The table below contains various fault symptoms with several possible causes of the fault in each case. The references given on the left indicate the first coordinate of the test step for the respective individual component of the Motronic. If, after testing the individual components, the fault has not been located or remedied, it is necessary to choose a new fault symptom.

#### Customer complaint (fault symptoms)

1. Engine fails to start or starts only with great difficulty
    2. Engine starts but then dies
      3. Uneven engine idle, idle speed incorrect
        4. Poor throttle take-up
          5. Engine missing under all operating conditions
            6. Fuel consumption too high
              7. No maximum engine power
                8. CO concentration at idle too high or too low
- Cause (component fault)

B11	B11	B11	B11	B11	B11	B11	B11	Test with universal test adapter
•*)								Relay combination (main and pump relay) defective
•*)								Electric fuel pump not operating
F14	G 9		H23					Auxiliary-air device not opening
		H 1						Auxiliary-air device not closing
G 1	G15	G19	H19	J 7	J23	K 5	K17	Air-flow sensor defective

Continued on B7/B8/B9/B10



# Customer complaints (fault symptoms)

1. Engine fails to start or starts only with great difficulty

2. Engine starts but then dies

3. Uneven engine idle, idle speed incorrect

4. Poor throttle take-up

5. Engine missing under all operating conditions

6. Fuel consumption too high

7. No maximum engine power

8. CO concentration at idle too high or too low

Cause (component fault)

●*)								Main relay
G 1	G 7	G23	H21				K21	Air-intake system leaking
F10		H 7						Solenoid-operated injection valves defective
●*)		●*)				●*)		Fuel pressure too low or zero; pressure regulator not operating
		●*)			●*)	●*)		Fuel pressure too high; pressure regulator not operating
				J 9		K 7		Fuel delivery too low
	●*)				●*)	●*)		Temperature sensor I (air) or temperature sensor II (coolant) defective
		G21	H17					Throttle valve not closing
						K 3		Throttle valve not opening fully
				J 5				Poor central ground, loose contacts, faulty plug-in connections
G 1	G 7	G23	H21	J 5		K13	K21	Open circuit in wiring harness and plug-in connections
		●*)				●*)		Microswitch (idle contact) defective
		H11					K23	CO exhaust-gas setting too rich, idle adjustment
		H11	●*)				K23	CO exhaust-gas setting too lean, idle adjustment
F16								Start valve not opening
						●*)		Throttle-valve switch (full-load contact) defective (not for 745i)

Continued on B9/B10

**B7**

Trouble-shooting

BMW 6 and 7 series with elec. trans.



**B8**

Trouble-shooting

BMW 6 and 7 series with elec. trans.



# Customer complaints (fault symptoms)

1. Engine fails to start or starts only with great difficulty
  2. Engine starts but then dies
    3. Uneven engine idle, idle speed incorrect
      4. Poor throttle take-up
        5. Engine missing under all operating conditions
          6. Fuel consumption too high
            7. No maximum engine power
              8. CO concentration at idle too high or too low

								Cause (component fault)
	G11	H 3			J21		K19	Start valve not closing
F22	G13	H 3						Thermo-time switch defective
● *)								Engine-speed sensor defective
● *)								Reference-mark sensor defective
		G19		J 5		K 3		High-voltage distributor oil-fouled
		● *)			● *)			Altitude sensor (pressure sensor) only 745i
● *)	● *)	● *)	● *)		● *)	● *)	● *)	Control unit defective
+	+			+	+	+		Knock control defective (only 745i)

●\*) If you have performed the test with the Motronic test adapter, this component has already been tested. Continue testing with the next component in this column.  
 However, if you have arrived at this point through a component complaint or through the test-specifications table, you must test this component with the Motronic test adapter. The test program for the test adapter begins on Coordinate B11 and must be performed from beginning to end.

+ To test knock control, use specialized microcard.



8. TESTING WITH UNIVERSAL TEST ADAPTER ETT 018.01  
(0 684 101 801) AND ADAPTER LEAD FOR MOTRONIC  
(1 684 483 124)

Connect universal test adapter to Motronic cable harness (ignition must be switched off).

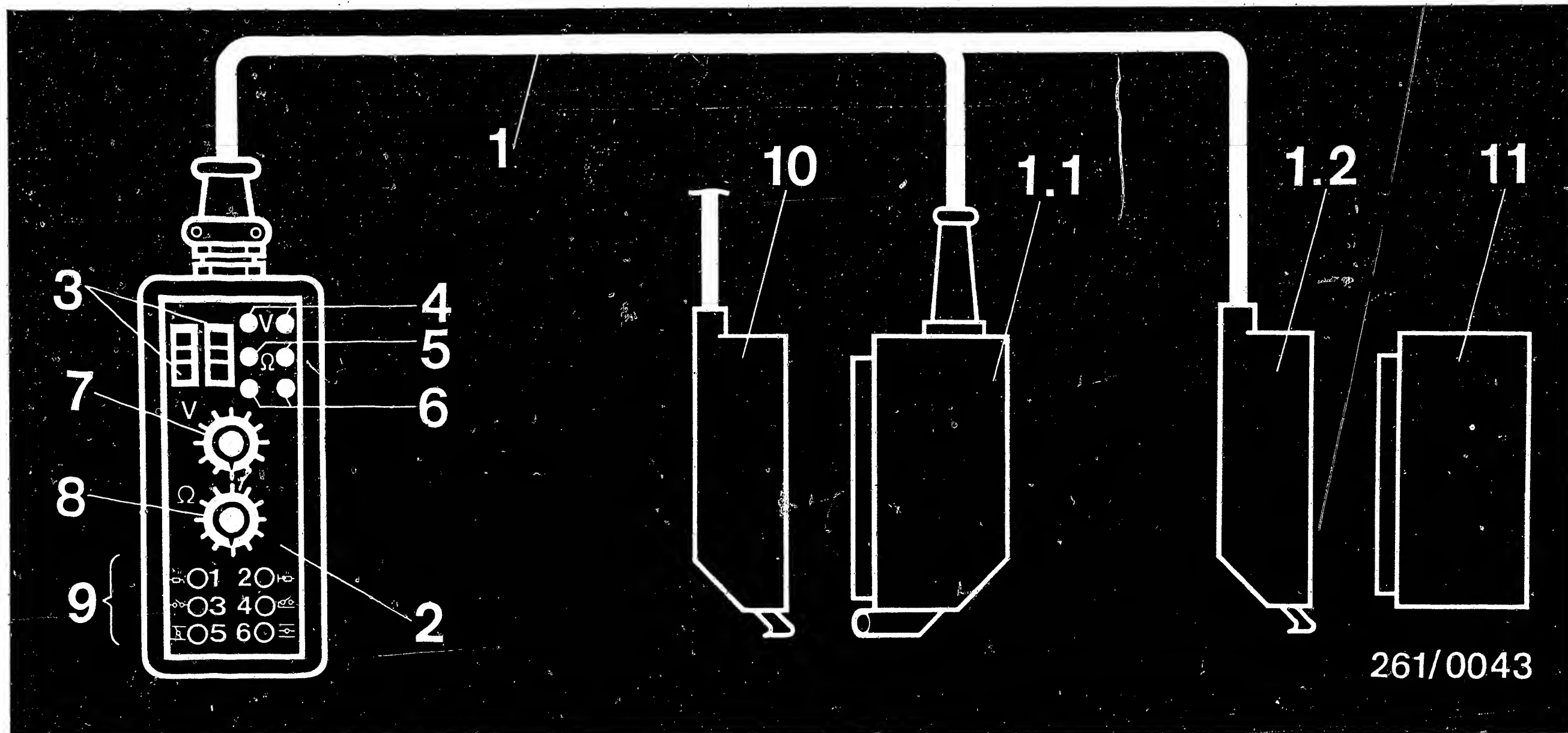
For testing the wiring harness and the connected components, only the Motronic wiring harness must be connected - but not the control unit. Be sure to observe the instructions in the test chart!

A pointer instrument for the voltage and resistance measurements (multimeter) as well as the motortester must be connected to the test adapter in order to make the measurements.

The individual test steps are selected with the program selector switch. The symbols V and  $\Omega$  show the operator whether voltage or resistance is being measured. Some switch positions are necessary for simulation of operating conditions with engine running. By pressing the pushbuttons it is possible, with the control unit connected and the engine running, to simulate given operating conditions. Thus, for example, with the engine at normal operating temperature it is possible by pressing the push-button T1 to make the control unit "think" that the engine temperature is -20°C. It is then possible to evaluate the reaction of the control unit on the motor-tester.

If necessary, the circuit diagram can be used for trouble-shooting.





261/0043

# Universal test adapter with adapter lead for Motronic

- 1 = Adapter lead
- 1.1 = Connection to wiring harness
- 1.2 = Connection to control unit
- 2 = Universal test adapter (part no. 0 684 001 801)
- 3 = Test wells (for motortester)
- 4 = Test sockets (for voltage measurement)
- 5 = Test sockets (for resistance measurement)
- 6 = Test sockets (not occupied)
- 7 = Program switch "V"
- 8 = Program switch "Ω"

- 9 = Button panel for simulation of operating conditions
- 10 = Motronic wiring harness
- 11 = Control unit
- Button 1 = NTC II (engine), cold (-20° C)
- Button 2 = NTC II (engine), warm (+80° C)
- Button 3 = Pump energization
- Button 4 = Not occupied
- Button 5 = Throttle-valve idle contact
- Button 6 = Throttle-valve full-load contact

**B12**

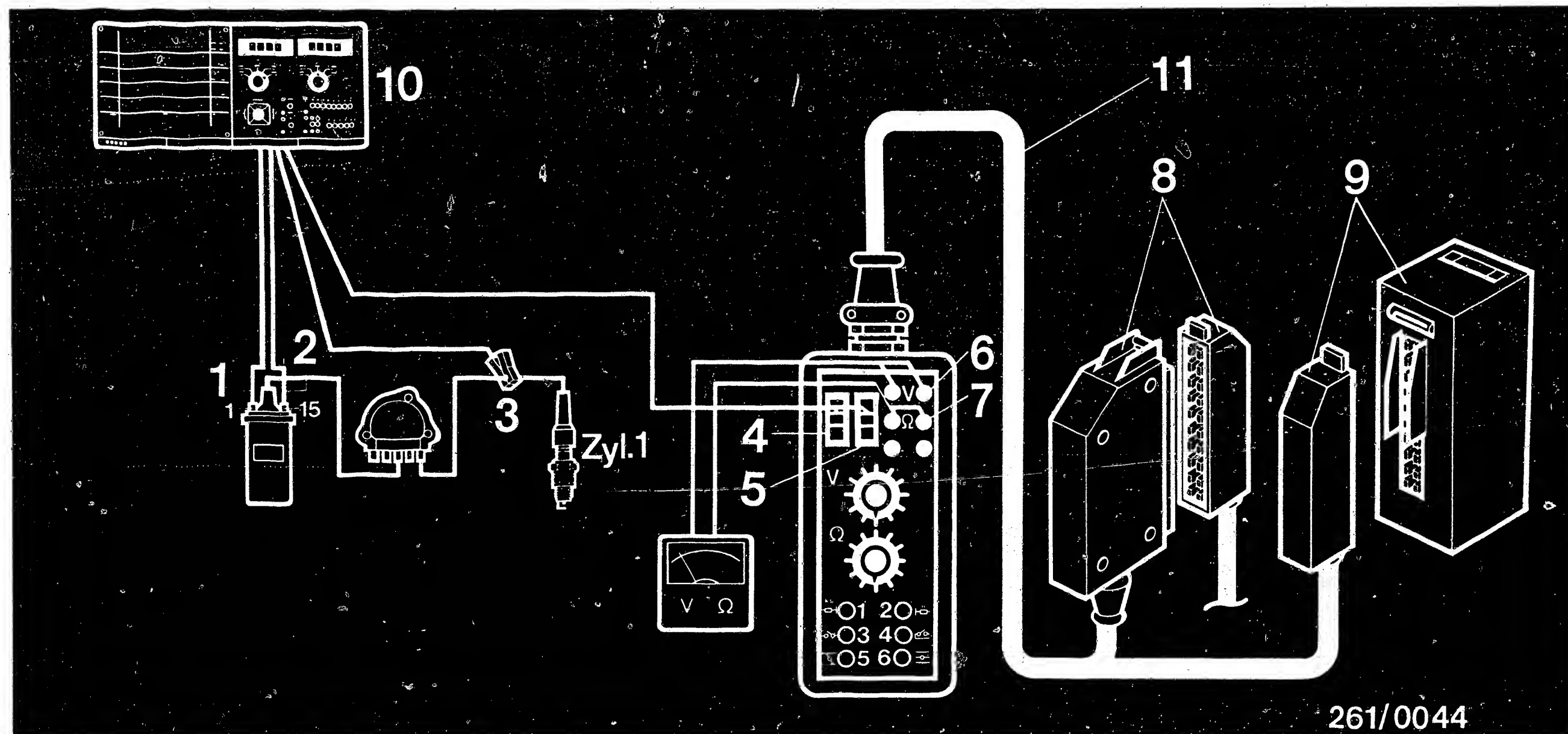
Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



**B13**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.





261/0044

### 8.1 Connection diagram for test adapter

- |  |  |
|--|--|
| 1 = Green clip to ignition coil term. 1                                    | 6 = Connection of voltmeter to V sockets (red = +, black = ground or negative) |
| 2 = Yellow clip to ignition coil term. 15                                  | 7 = Connection of ohmmeter to black $\Omega$ sockets (blue)                    |
| 3 = Induction-type clamp-on pickup over H.T. ignition cable of cylinder 1  | 8 = Connection to Motronic wiring harness                                      |
| 4 = Red connection socket (test well) for red terminal of motortester      | 9 = Connection to Motronic control unit  |
| 5 = Black connection socket (test well) for black terminal of motor tester | 10 = Motortester   |
|  | 11 = Adapter cable for Motronic  |

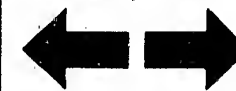
**B14**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



**B15**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.





## Preparations for testing with universal test adapter

### 1. Remove control unit and connect test adapter.

Installation position of control unit (7 series): behind side panelling on the right in footwell on front passenger side (6 series: glove compartment). The L-Jetronic control unit was previously accommodated here. To remove the control unit, push the plug detent back, hinge the plug up, and remove.

The control unit is fastened in position by 4 screws.

#### Note

To rule out any confusion between the 35-pin plugs of the different systems, a mechanical locking device has been introduced. The "lug" (pivot point when opening and connecting the control unit) and the corresponding mount on the control unit have matching recesses and pins. In addition to the mechanical locking device, the two 35-pin plugs are differently marked. The Motronic plug has a green cable binder.

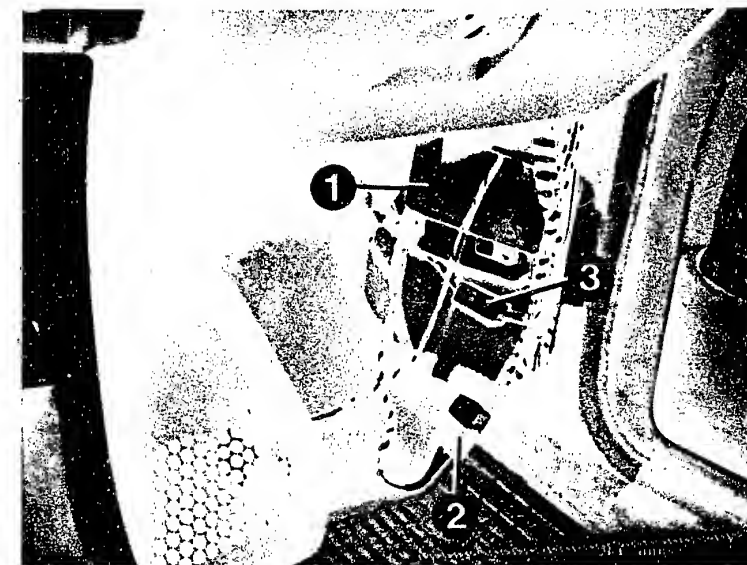
All illustrations refer to the 745i Turbo model

### 2. Remove pump relay (relay 1).

Installation position: at side on fuse box.

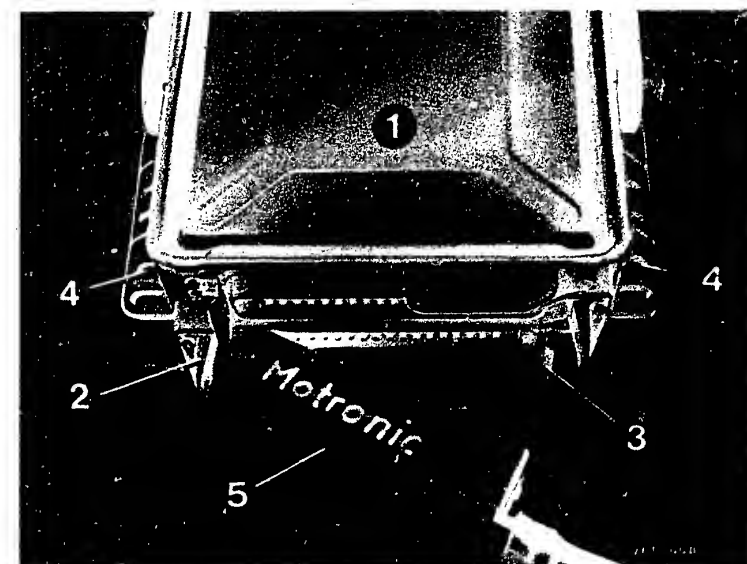
#### Note:

In the following test steps a white border in the "Operation" column indicates which operation has to be changed compared to the previous test step.



- 1 = Control unit
- 2 = Transmission relay
- 3 = 4-pin plug connector between transmission control and knock control

- 1 = Control unit
- 2 = Lug
- 3 = Detent
- 4 = Mounting holes
- 5 = Motronic plug



**B 16**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



**B 17**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



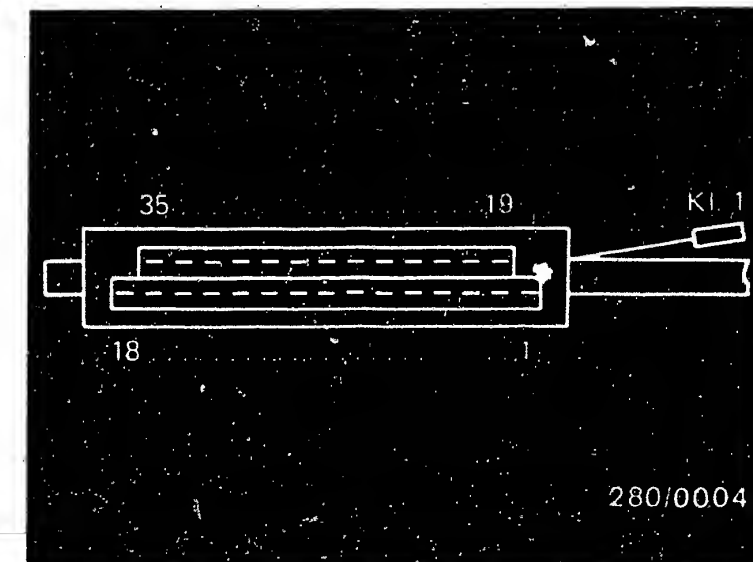
Test step 1: Switch off ignition. Disconnect control unit and pump relay

Operation		Reading	Testing
Program switch position "V"	↓	greater than 1 M $\Omega$	Component: Engine-speed sensor
Program switch position "Ω"	1		
Measuring equipment: Ohmmeter			Operation:
Measuring range: 10 M $\Omega$			Insulation between Term. 8 and ground
Connection: Test sockets	Ω		Malfunction: Resistance less than 1 M $\Omega$
Operation in vehicle: Switch off ignition.		If reading O.K., continue testing with next test step	

#### Trouble-shooting:

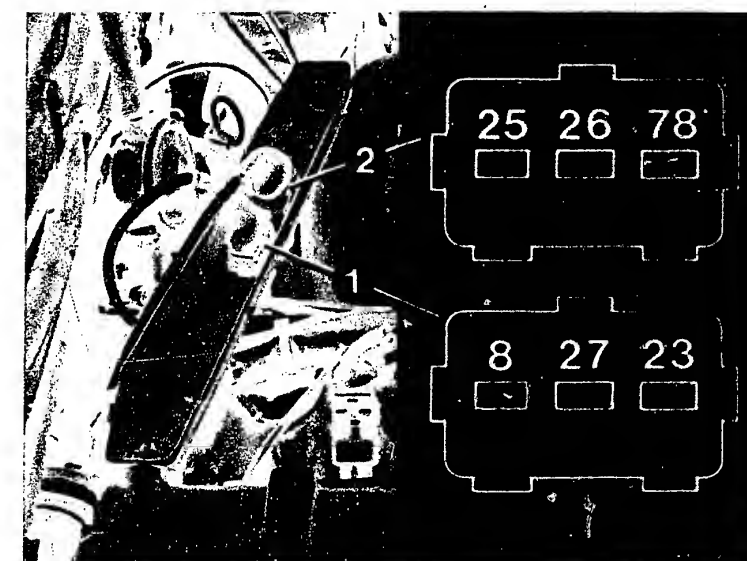
Resistance reading approx. 0  $\Omega$ :  
Check lead 8 for short circuit to ground.

Resistance reading 0.6...1.6 k $\Omega$ :  
Check lead 27 for short circuit to ground.



To view of 35-pin control unit plug (black) from Motronic wiring harness  
term. 1 = plug connection to tachometer

- 1 = Plug connection for engine-speed sensor with black plug
- 2 = Plug connection for reference-mark sensor with gray plug



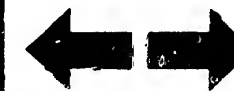
**B18**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



**B19**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.

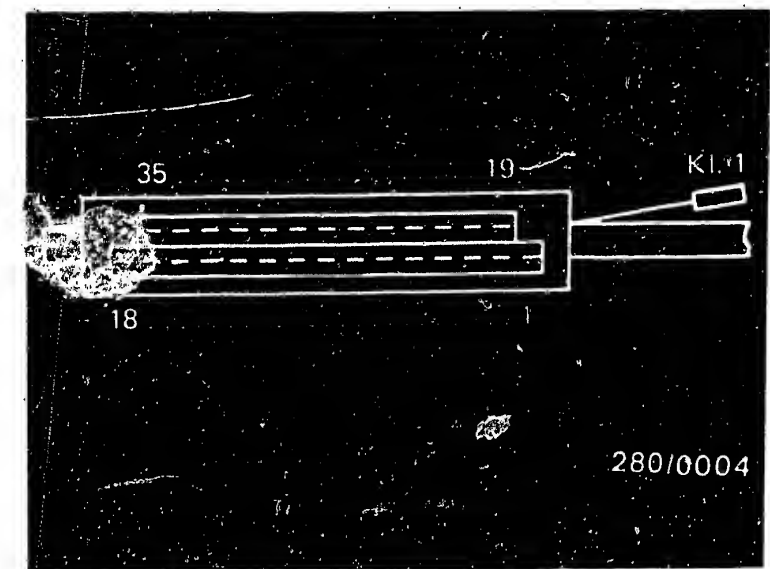


Test step 2		
Operation		Reading
Program switch position "V"	↓	Greater than 1 M $\Omega$
Program switch position "Ω"	2	
Measuring equipment: Ohmmeter		
Measuring range: 10 M $\Omega$		If reading O.K., continue testing with next test step
Connection: Test sockets $\Omega$		
Operation in vehicle: Switch off ignition.		
		Testing
		Component: Reference-mark sensor
		Operation: Insulation between Term. 25 and ground
		Malfunction: Resistance less than 1 M $\Omega$

#### Trouble-shooting:

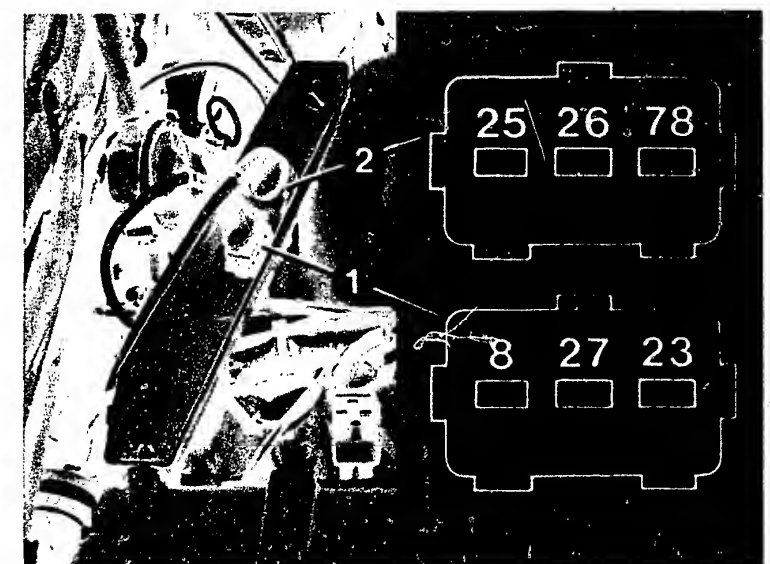
Resistance reading approx. 0  $\Omega$ :  
Check lead 25 for short circuit to ground.

Resistance reading 0.6...1.6 k $\Omega$ :  
Check lead 26 for short circuit to ground.



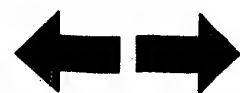
To view of 35-pin control unit plug (black) from Motronic wiring harness term. 1 = plug connection to tachometer

- 1 = Plug connection for engine-speed sensor with black plug
- 2 = Plug connection for reference-mark sensor with gray plug



**B20**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



**B21**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



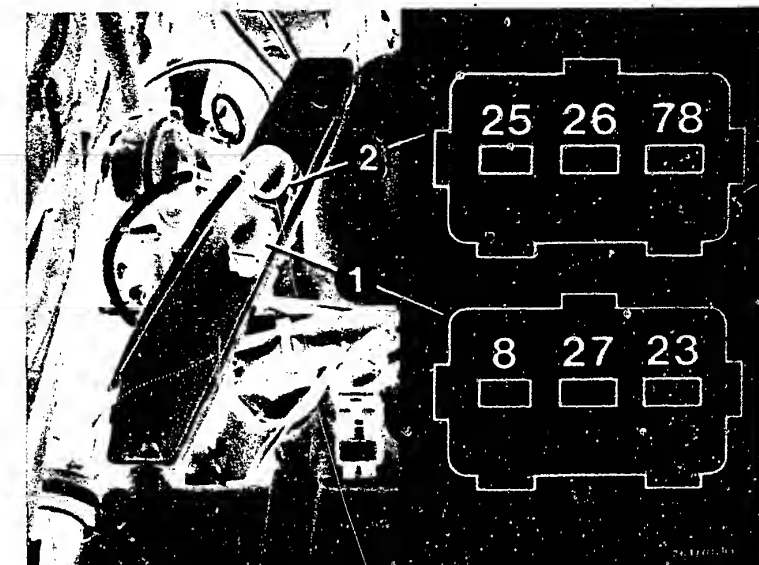
Test step 3			
Operation		Reading	Testing
<u>Program switch position</u> "V"	↓	<u>0.6...1.6 kΩ</u>  If reading O.K., continue testing with next test step	<u>Component:</u>  Engine-speed sensor
<u>Program switch position</u> "Ω"	3		
<u>Measuring equipment:</u> Ohmmeter			<u>Operation:</u>  Winding resistance between Term. 8 and Term. 27
<u>Measuring range:</u> 0 to 10 kΩ			
<u>Connection:</u> Test sockets	Ω		<u>Malfunction:</u>  Resistance outside tolerance
<u>Operation in vehicle:</u> Switch off ignition			

#### Trouble-shooting:

- Repeat measurement directly at sensor plug.
- Check plug-in connection: Corrosion, loose contact (spring contacts must not allow themselves to be pushed back)
- Check leads from engine-speed sensor term. 8 and term. 27 to control unit plug term. 8 and term. 27.
- Replace sensor.

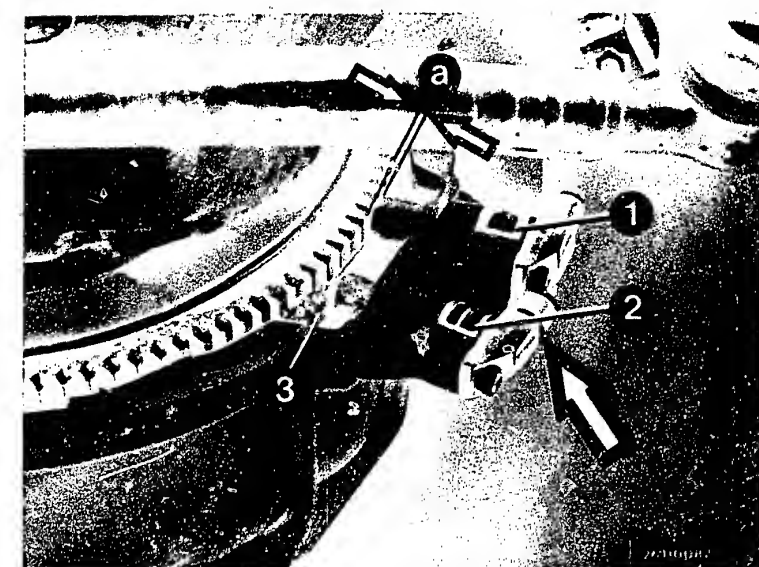
To replace the sensors, undo the plug-in connection and unscrew the hexagon-socket-head cap screw on the sensor. Remove dirt deposits on the sensor. If necessary, apply two screwdrivers to the recesses to left and right of the sensor and raise the sensor.

Continued on B 24



- 1 = Plug connection for engine-speed sensor with black plug  
2 = Plug connection for reference-mark sensor with gray plug

- 1 = Engine-speed sensor (D)  
2 = Reference-mark sensor (B)  
3 = Reference mark  
a = Air gap  
Arrow = Identification for reference-mark sensor



**B22**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



**B23**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



### Trouble-shooting - Test step 3 (continued)

Before installing the sensors, make sure that no metallic parts are sticking to the sensor (sensor contain permanent magnets). Grease sensors with Molykote Longterm 2.

Do not mix up the sensors when installing!

#### Pay attention to markings:

The reference-mark sensor is identified with a cable binder.

The sensors are plugged into the bores as far as they will go and screwed down. Do not use force when inserting.


When mounting, make sure that the connectors are the right way round.

Make sure that the spring contacts in the plug are correctly seated and latch in.

It must not be possible to push back the spring contacts.





Test step 4		
Operation	Reading	Testing
Program switch position "V" 	<p><u>0.6...1.6 k<math>\Omega</math></u></p> <p>If reading O.K., continue testing with next test step</p>	Component:
Program switch position "Ω" 4		Reference-mark sensor
Measuring equipment: Ohmmeter		Operation:
Measuring range: 0 to 10 k $\Omega$		Winding resistance between Term. 25 and Term. 26
Connection: Test sockets Ω		Malfunction: Resistance outside tolerance.
Operation in vehicle: Switch off ignition		

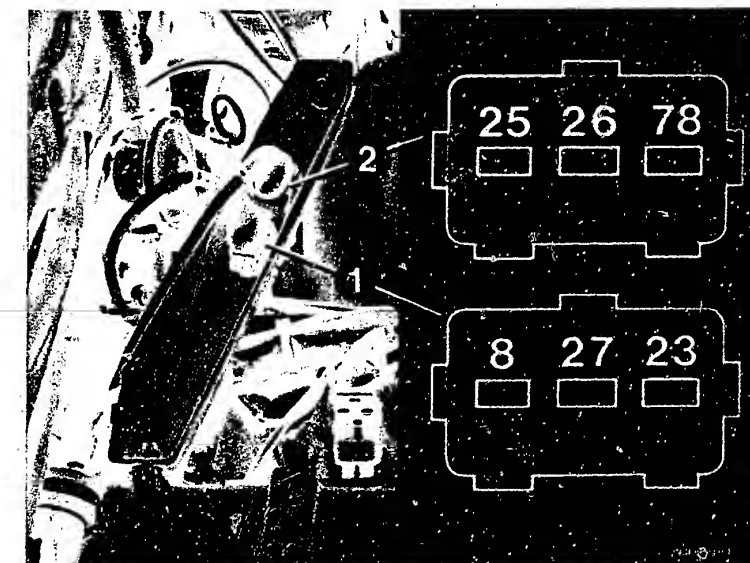
#### Trouble-shooting:

- Repeat measurement directly at sensor plug.
- Check plug-in connection for corrosion, loose contact (spring contacts must not allow themselves to be pushed back)
- Check leads from reference-mark sensor term. 25 and term. 26 to control unit plug term. 25 and term. 26.
- Replace sensor.

To replace the sensors, unscrew the hexagon-socket-head cap screw on the sensor. Remove dirt deposits from sensor. If necessary, apply two screwdrivers to the recesses to left and right of the sensor and raise sensor.

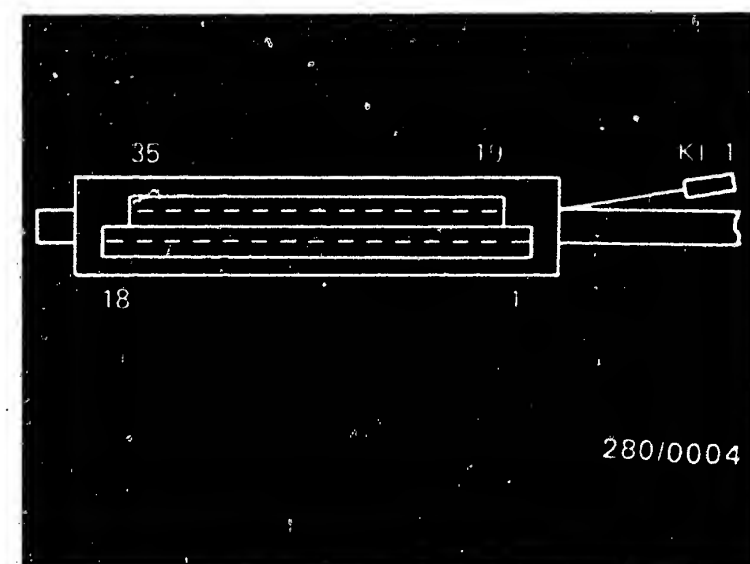
Caution! Do not loosen mounting.

Continued on C 3/C 4



- 1 = Plug connection for engine-speed sensor with black plug  
2 = Plug connection for reference-mark sensor with gray plug

To view of 35-pin control unit plug (black) from Motronic wiring harness term. 1 = plug connection to tachometer



**C1**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



**C2**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



### Trouble-shooting - Test step 4 (continued)

Before installing the sensors, make sure that no metallic parts are sticking to the sensor (sensors contain permanent magnets). Grease sensors with Molykote Longterm 2.

Do not mix up the sensors when installing!

#### Pay attention to markings:

The reference-mark sensor is identified with a cable binder.

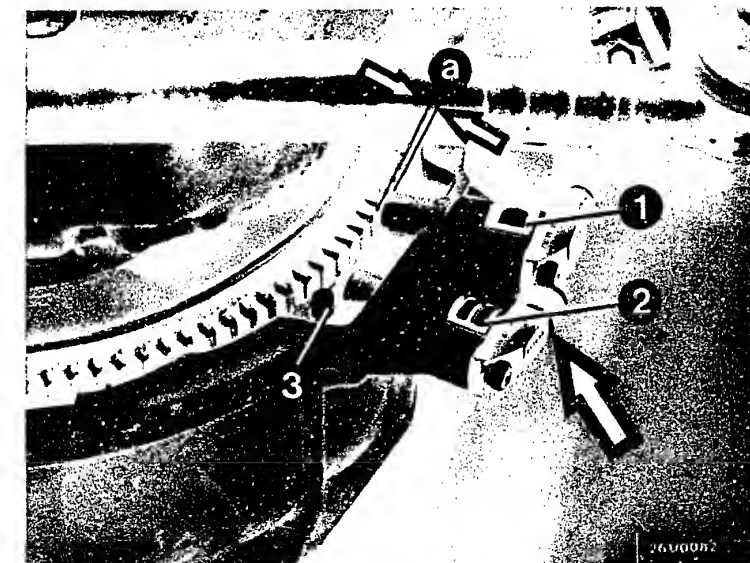
The sensors are plugged into the holes as far as they will go and are secured.

Do not use force when inserting.

When installing, make sure that the connectors are not mixed up.

Make sure that the spring contacts in the plug are seated properly and that they latch in position.

Spring contacts must not allow themselves to be pushed back.



- 1 = Engine-speed sensor (D)
- 2 = Reference-mark sensor (B)
- 3 = Reference mark
- a = Air gap
- Arrow = Identification for reference-mark sensor

**C3**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



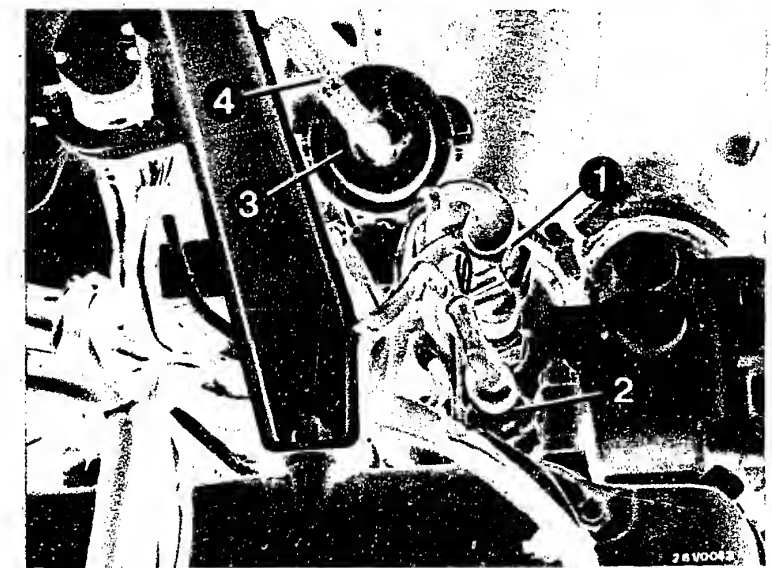
**C4**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.





Test step 5			
Operation		Reading	Testing
Program switch position "V"	↓	Reading is temperature -dependent, i.e. note engine temperature. At ambient temper- ature (+15°...+30°C): 1.45...3.3 kΩ  With engine at normal operating temperature (approx. + 80° C): 280...360Ω  If reading O.K., continue testing with next test step.	<u>Component:</u>  Engine temperature sensor (NTC II)
Program switch position "Ω"	5		<u>Operation:</u>  Resistance between Term. 13 and ground
Measuring equipment: Ohmmeter			<u>Malfunction:</u>  Resistance outside tolerance. Note temperature.
Measuring range:  0 to 10 kΩ			
Connection: Test sockets	Ω		
Operation in vehicle: Switch off ignition			



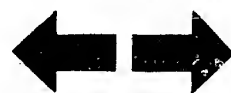
- 1 = Thermo-time switch
- 2 = Engine temperature sensor (NTC II)
- 3 = Pressure regulator
- 4 = Return hose

#### Trouble-shooting:

- Remove plug from temperature sensor and measure resistance directly. If necessary, replace temperature sensor.
- Test leads from temperature sensor to control unit plug term. 13 and to ground terminal.
- Eliminate contact resistances at the plug-in connections.  
Spring contacts must not allow themselves to be pushed back.

**C5**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.

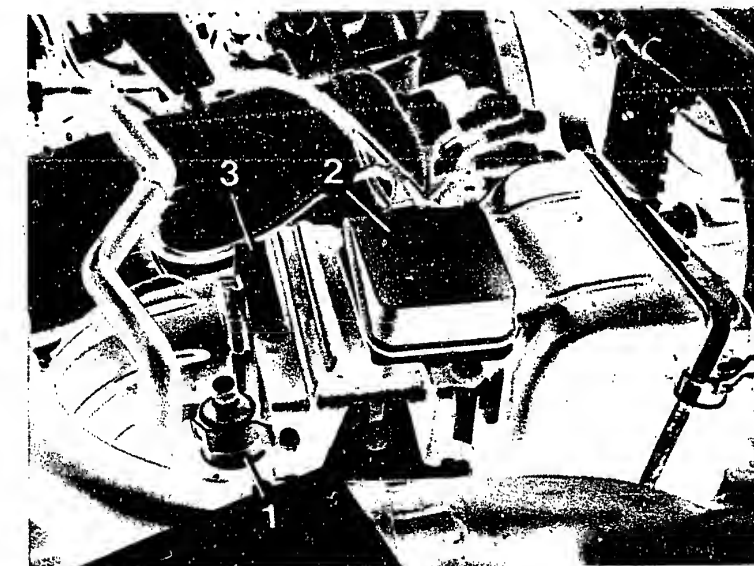


**C6**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.

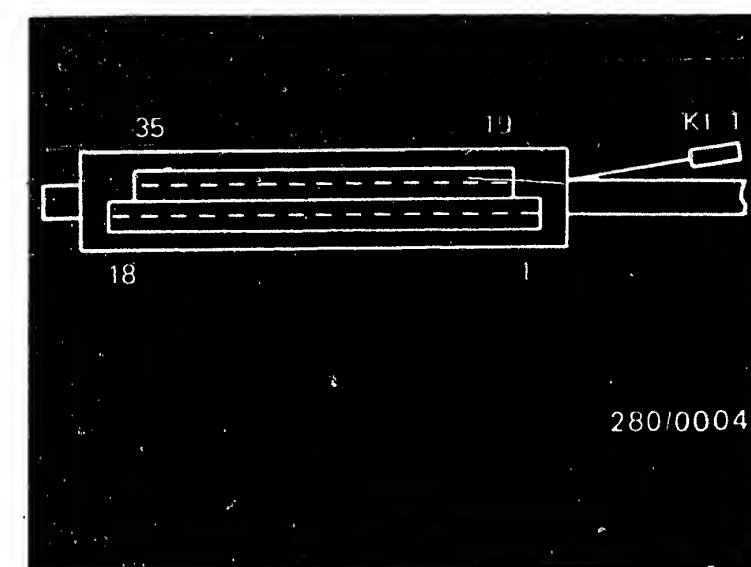


Test step 6			
Operation		Reading	Testing
Program switch position "V"	↓	Reading is temperature -dependent, i.e. note engine temperature. At ambient temper- ature (+15°...+30° C): <u>1.45...3.3 kΩ</u>  With engine at normal operating temperature (approx. + 80° C): <u>280...360Ω</u>  If reading O.K., continue testing with <u>next test step</u>	<u>Component:</u> Air temperature sensor (NTC I)
Program switch position "Ω"	6		
<u>Measuring equipment:</u> Ohmmeter			<u>Operation:</u> Resistance between Term. 22 and ground
<u>Measuring range:</u> 0 to 10 kΩ			
<u>Connection:</u> Test sockets	Ω		<u>Malfunction:</u> Resistance outside tolerance. Note temperature.
<u>Operation in vehicle:</u> Switch off ignition			



- 1 = Solenoid-operated valve  
 2 = Air-flow sensor with NTC I  
 3 = Idle-mixture-adjusting screw

To view of 35-pin control unit plug (black) from Motronic wiring harness term. 1 = plug connection to tachometer



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#### Trouble-shooting:

- Remove plug from air-flow sensor and measure resistance directly at Term. 22 and Term. 6. If reading outside tolerance, replace air-flow sensor.
- Leads from air-flow sensor term. 6 and term. 22 to control unit plug term. 6 and term. 22.
- Eliminate contact resistances in the plug-in connections.  
Spring contacts must not allow themselves to be pushed back.

**C7**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



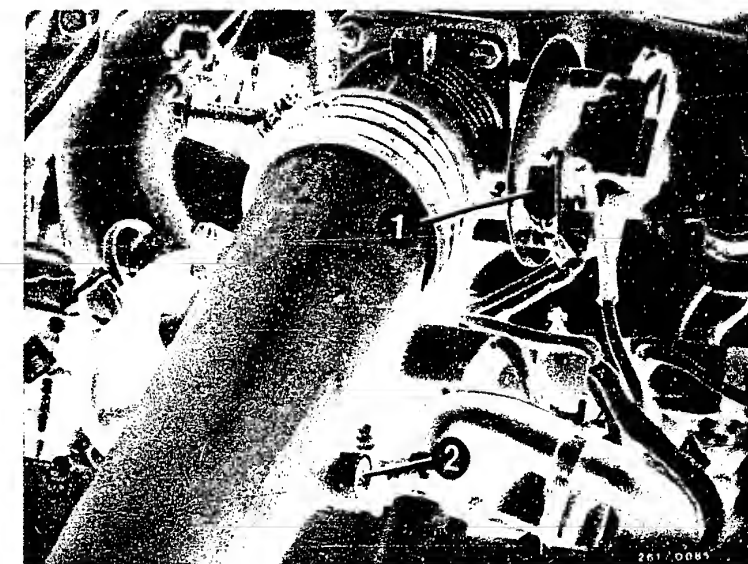
**C8**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



Test steps 7 and 8 deleted!

Test step 9			
Operation		Reading	Testing
Program switch position "V"	↓	Accelerator in rest position: Less than 10 $\Omega$	Component: Throttle-valve switch (Microswitch)
Program switch position "Ω"	9	(Measured value is influenced by protective resistor in adapter).	Operation: Idle contact between terminal 2 and ground
Measuring equipment: Ohmmeter		Accelerator depressed (Part-load range): $\infty \Omega$ <sup>1)</sup>	Malfunction: Resistance in rest position greater than 10 $\Omega$ or less than $\infty \Omega$ .
Measuring range: 0 to 10 k $\Omega$			
Connection: Test sockets	Ω	If reading O.K., continue testing with next test step.	
Operation in vehicle: Switch off ignition			



- 1 = Microswitch (idle contact)  
2 = Idle-speed-adjusting screw

#### Trouble-shooting:

##### 1) Adjusting the microswitch

Loosen the fastening screws. Turn the operating lever to full throttle and slowly return to the idle stop. Reading less than 10  $\Omega$ .

Turn the switch in a clockwise direction until the inner stop can be felt. Tighten screws.

Continued on C11/C12

**C9**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



**C10**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



### Trouble-shooting - throttle-valve switch (continued)

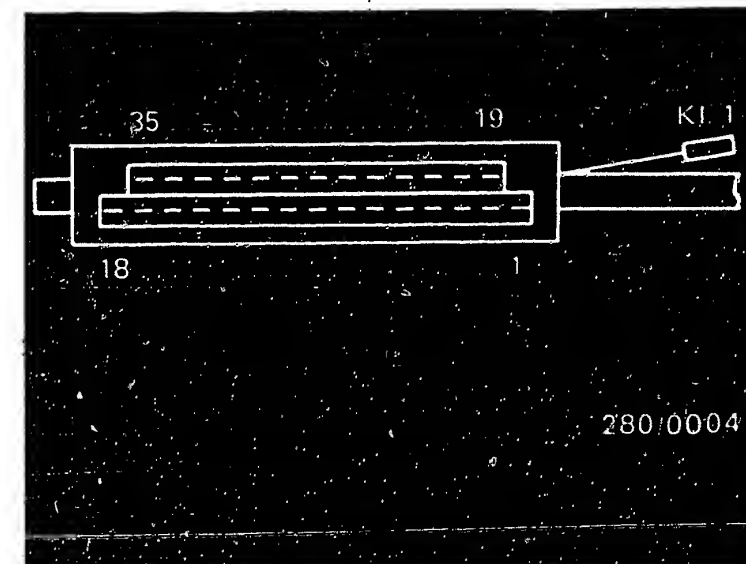
Check: Slowly open throttle in full-load direction. Reading must change to  $\infty \Omega$  shortly after the throttle is opened.

If no adjustment is possible:

Check microswitch (idle contact) and leads from microswitch to control unit plug term. 2 or to ground terminal.

Eliminate contact resistances.

Spring contacts must not allow themselves to be pushed back.



To view of 35-pin control unit plug (black) from Motronic wiring harness term. 1 = plug connection to tachometer

**C11**


Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



**C12**

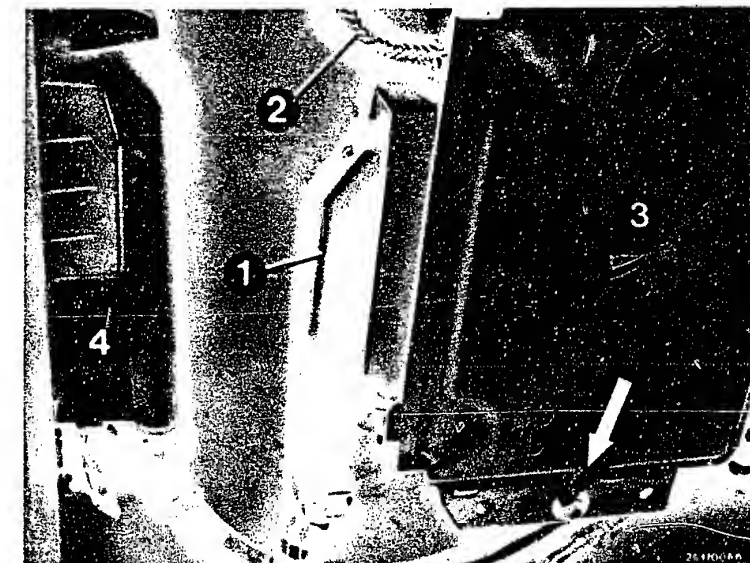
Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



Test step 10			
Operation		Reading	Testing
Program switch position "V"		Depress accelerator pedal as far as it will go: <u>Less than 10 Ω</u>	<u>Component:</u> Full-load contact, or with 745i, knock-control unit
Program switch position "Ω"	10	745i: Accelerator pedal need not be pressed since it has no influence on test: <u>1 ... 9 kΩ</u>	<u>Operation:</u> Full-load signal between term. 3 and ground (on 745i, via knock-control unit)
<u>Measuring equipment:</u> Ohmmeter		If reading O.K. continue testing with <u>next test step</u>	<u>Malfunction:</u>  Resistance outside tolerance
<u>Measuring range:</u> 0 to 10 kΩ			
<u>Connection:</u> Test sockets	Ω		
<u>Operation in vehicle:</u> Switch off ignition			

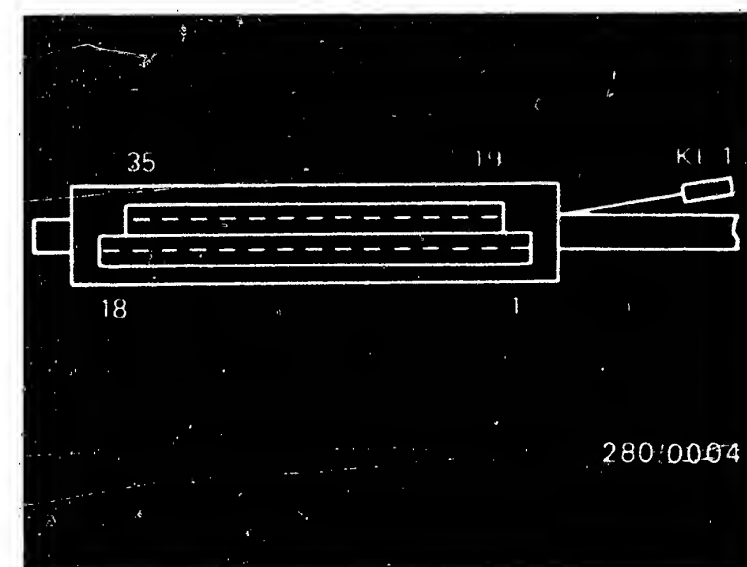
#### Trouble-shooting:

- Check full-load contact and leads.
- Check plug connections and leads from control unit plug term. 3 to knock-control unit term. 13 (745i)  
Check lead from knock-control unit term. 12 to ground, and check ground terminal (745i).
- If plug connections and leads OK, replace knock-control unit (745i)



- 1 = Plug for knock control unit  
2 = Vacuum hose  
3 = Knock control unit  
4 = ABS plug  
Arrow = Fastening screw

To view of 35-pin control unit plug (black) from Motronic wiring harness term. 1 = plug connection to tachometer



280'0004

**C13**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



**C14**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



Test step 11			
Operation		Reading	Testing
Program switch position "V"	↓	Less than 10 $\Omega$ .  (Measured value is influenced by protective resistor in adapter)	Component: Ground lead
Program switch position "Ω"	11		Operation: Contact resistance between Term. 16 and ground
Measuring equipment: Ohmmeter			
Measuring range: 0 to 10 k $\Omega$			
Connection: Test sockets	Ω	If reading O.K., continue testing with next test step	Malfunction: Resistance greater than 10 $\Omega$
Operation in vehicle: Switch off ignition			

#### Trouble-shooting:

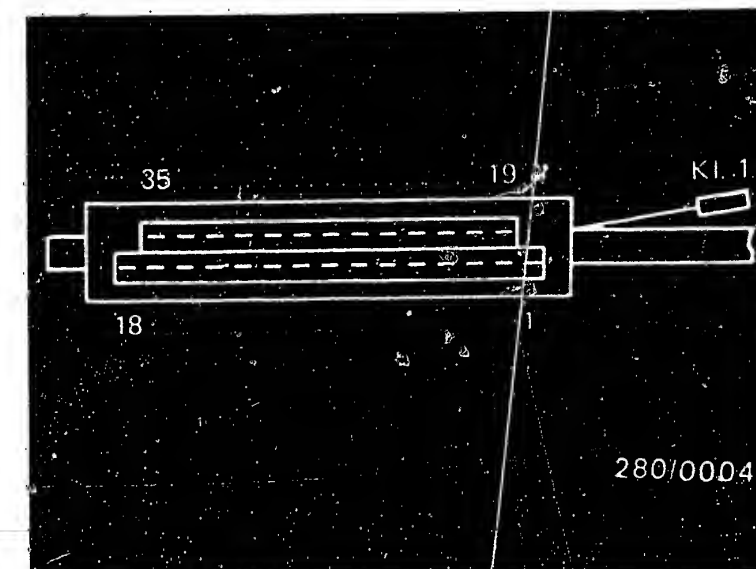
For testing, remove wiring-harness plug from test adapter and, if necessary, use circuit diagram.

Test the following leads for continuity using ohmmeter (set value approx. 0 $\Omega$ ):

- From control unit plug term. 16 to ground terminal.
- From control unit plug term. 5 to ground terminal.

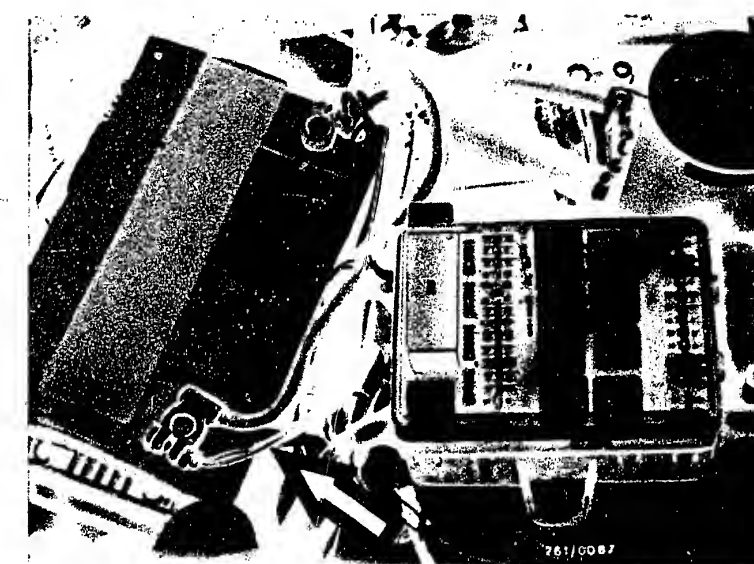
Eliminate contact resistances at connection points.

Spring contacts must not allow themselves to be pushed back.



To view of 35-pin control unit plug (black) from Motronic wiring harness  
term. 1 = plug connection to tachometer

Arrow = Ground lead of Motronic



**C15**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



**C16**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.





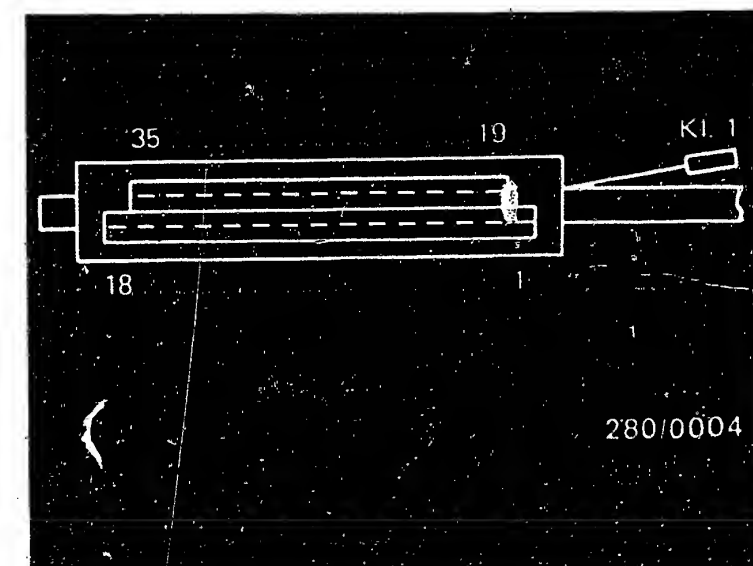
Test step 12			Reading	Testing
Operation				
Program switch position "V"	↓		<u>Less than 10 Ω.</u>  (Measured value is influenced by protective resistor in adapter)	<u>Component:</u>  Ground lead
Program switch position "Ω"		12		
<u>Measuring equipment:</u>				<u>Operation:</u>  Contact resistance between Term. 17 and ground
Ohmmeter				
<u>Measuring range:</u>				
0 to 10 kΩ				
<u>Connection:</u>			If reading O.K., <u>continue testing with next test step</u>	<u>Malfunction:</u>  Resistance greater than 10 Ω
Test sockets	Ω			
<u>Operation in vehicle:</u>				
Switch off ignition				

For testing, remove wiring-harness plug from test adapter and, if necessary, use circuit diagram.

- From control unit plug term. 17 to ground terminal.
- From control unit plug term. 5 to ground terminal.

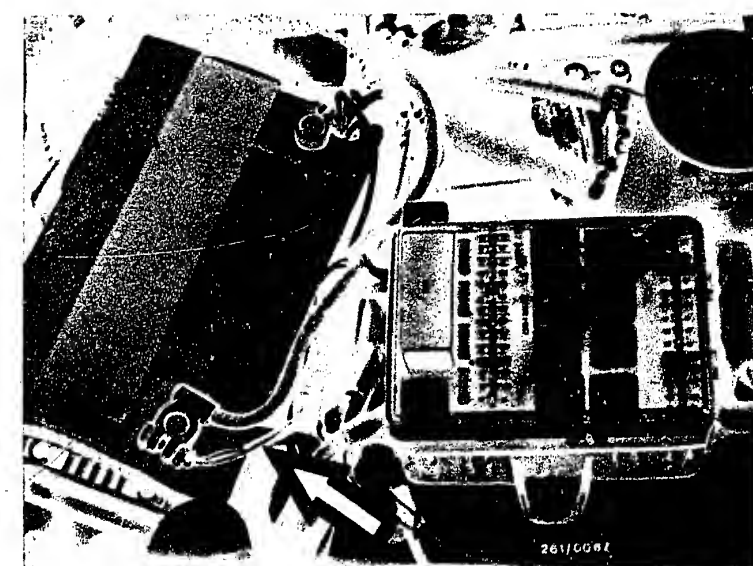
Eliminate contact resistances at connection points.

Spring contacts must not allow themselves to be pushed back.



To view of 35-pin control unit plug  
(black) from Motronic wiring harness  
term. 1 = plug connection to  
tachometer

Arrow = Ground lead of Motronic



Test step 13		
Operation	Reading	Testing
Program switch position "V"	<div>↓</div> <div>13</div> <div>           Less than 10 <math>\Omega</math>.            (Measured value is influenced by protective resistor in adapter)         </div>	Component: Ground lead
Program switch position "Ω"		Operation: Contact resistance between Term. 19 and ground
Measuring equipment: Ohmmeter		Malfunction: Resistance greater than 10 $\Omega$
Measuring range: 0 to 10 k $\Omega$	<div>If reading O.K., continue testing with next test step</div>	
Connection: Test sockets		
Operation in vehicle Switch off ignition		

### Trouble-shooting

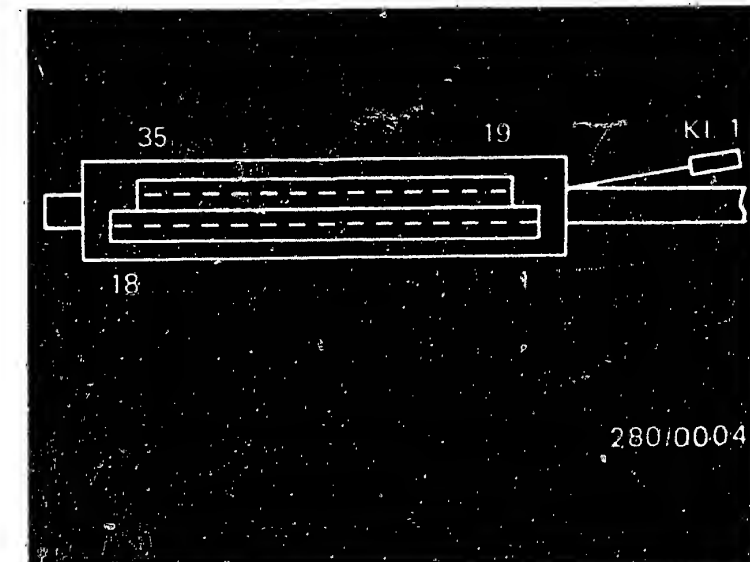
For testing, remove wiring-harness plug from adapter and, if necessary, use circuit diagram.

Test the following leads for continuity using ohmmeter (set value approx. 0  $\Omega$ )

- From control unit plug term. 19 to ground terminal.
- From control unit plug term. 5 to ground terminal.

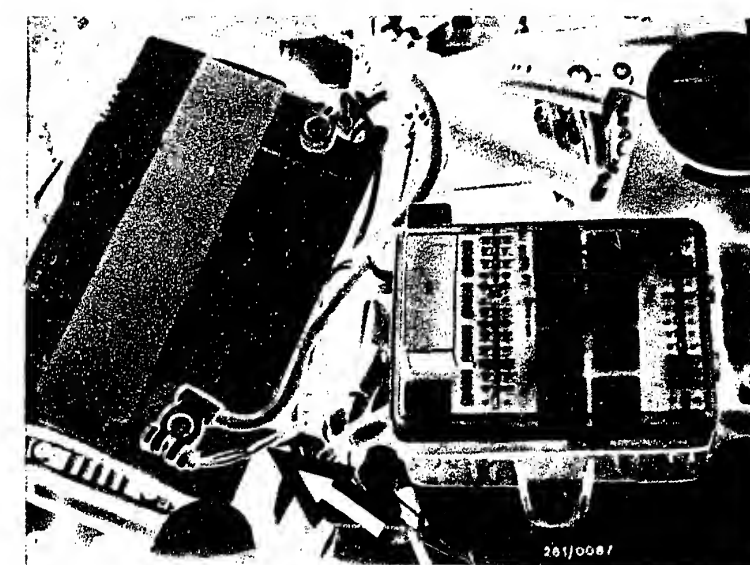
Eliminate contact resistances at connection points.

Spring contacts must not allow themselves to be pushed back.



To view of 35-pin control unit plug (black) from Motronic wiring harness term. 1 = plug connection to tachometer

Arrow = Ground lead of Motronic



**C19**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



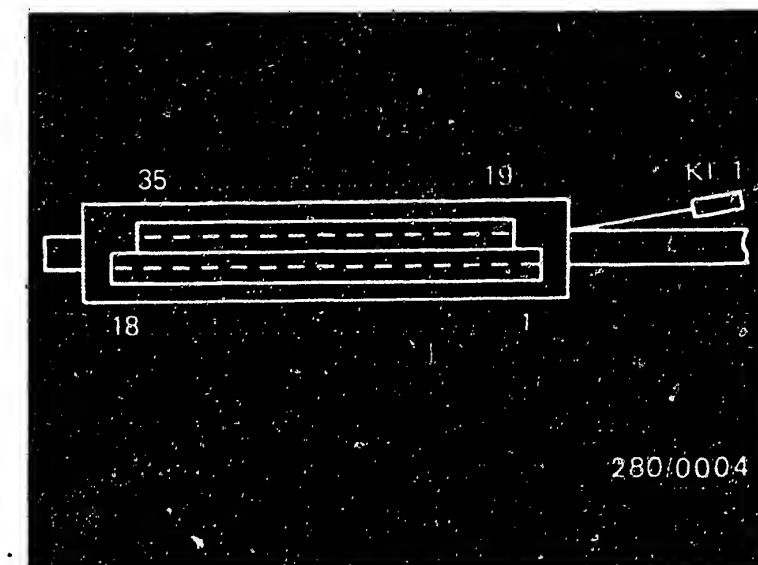
**C20**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



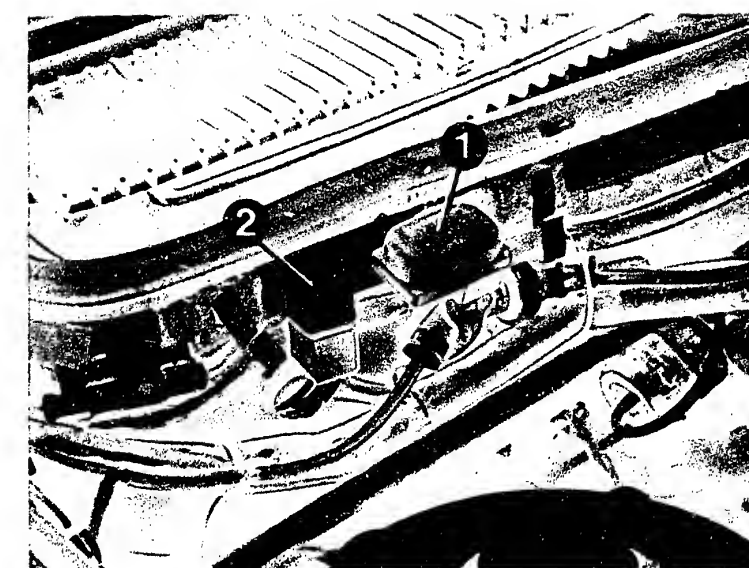


TEST STEP 14:			
Operation:		Reading:	Testing:
Program switch "V" at position:	↓	0.4...2.3 k $\Omega$ (Reading is influenced by altitude. Dependence on altitude is taken into account in test step 15)	Component:  Altitude sensor (pressure sensor)
Program switch "Ω" at position:	14		
Measuring equipment: Ohmmeter			Operation:  Resistance between term. 30 and ground (lead 92)
Measuring range: 0 to 10 k $\Omega$		If reading O.K., continue testing with next test step.	
Connection: Test sockets	Ω		Malfunction:  Resistance outside tolerance
Operation in vehicle: Switch off ignition			



To view of 35-pin control unit plug (black) from Motronic wiring harness term. 1 = plug connection to tachometer

1 = Altitude sensor  
2 = Main relay



### Trouble-shooting:

For testing, remove wiring-harness plug from test adapter and use circuit diagram if necessary.

Test the following leads for continuity using ohmmeter (set value approx. 0  $\Omega$ ):

- From control unit plug term. 30 to altitude sensor (lead 30).
- From altitude sensor (lead 92) to ground terminal.

Eliminate contact resistances at the connection points.

It must not be possible to push back the spring contacts.

Replace altitude sensor.

**C21**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.

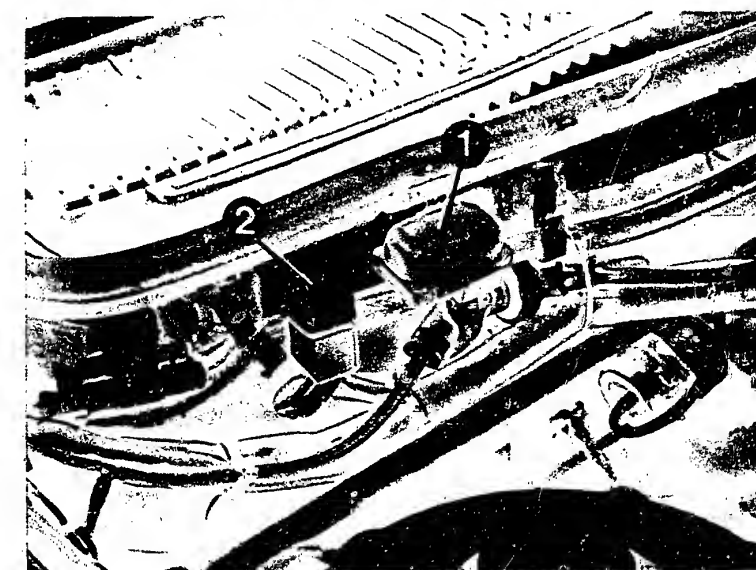


**C22**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.

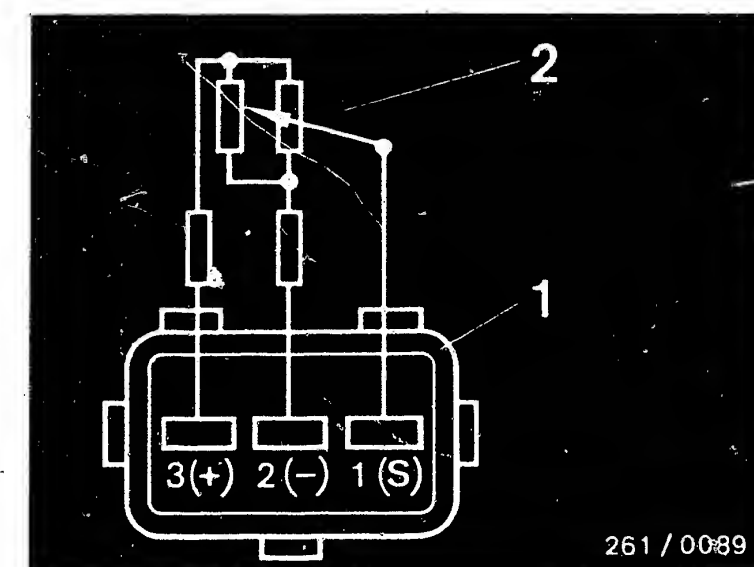


TEST STEP 15: Caution! By way of exception, voltage is measured at the $\Omega$ sockets. Change over measuring instrument before switching on ignition.			
Operation:		Reading:	Testing:
Program switch "V" at position:	↓	Voltage reading is dependent on altitude and battery voltage. With increasing battery voltage and altitude the wiper voltage at the altitude sensor rises.	Component:
Program switch " $\Omega$ " at position:	14		Altitude sensor (pressure sensor)
Measuring equipment:			Operation:
Voltmeter		0 m: 1.5...3.5 V	Wiper voltage at pressure sensor measured between term. 30 and ground.
Measuring range:		500 m: 2.5...5 V	
15 V		1000 m: 3.5...6.0 V	Malfunction:
Connection:		1500 m: 4.5...7.5 V	
Test sockets	$\Omega$	(U <sub>battery</sub> between 10 V and 14 V).	
Operation in vehicle:			
Switch on ignition			



1 = Altitude sensor  
2 = Main relay

1 = Top view of plug connection on pressure sensor  
S = Wiper of potentiometer  
2 = Altitude sensor potentiometer



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### Trouble-shooting:

#### No voltage can be measured:

Using test step 20, determine whether main relay is O.K. If main relay O.K., check lead 90 from main relay to altitude sensor. If lead and plug connector O.K., replace pressure sensor.

#### Voltage outside tolerance:

Note atmospheric pressure and battery voltage.  
Replace altitude sensor.

**C23**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



**C24**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



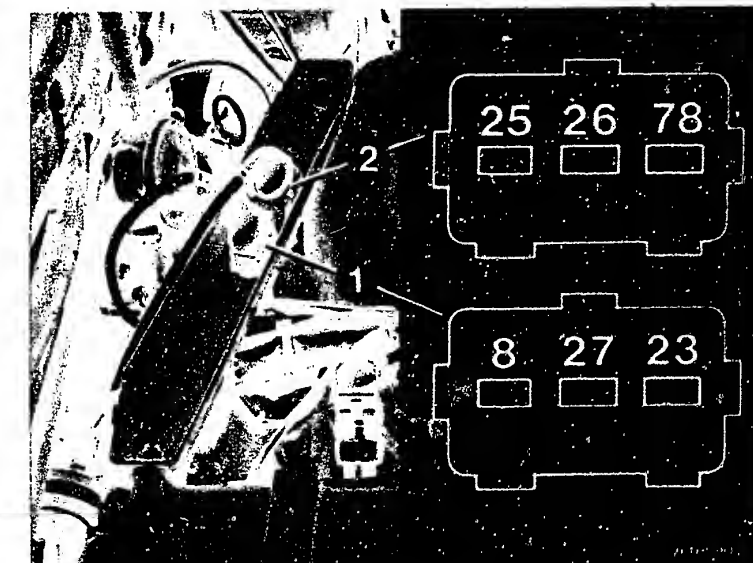
Test step 16		
Operation	Reading	Testing
Program switch position "V"	1	<u>Component:</u>  Engine-speed sensor
Program switch position "Ω"	15	
<u>Measuring equipment:</u> Motortester, oscilloscope <u>Measuring range:</u> Special input	Lever to left-hand stop (calibrated voltage range)  If reading O.K., continue testing with next test step.	<u>Operation:</u>  Amplitude (signal) at terminals 8 and 27
<u>Connection:</u> Test wells; red clip to red well, black clip to black well		<u>Malfunction:</u>  No signal or signal too small. Incorrect signal
<u>Operation in vehicle:</u> Shift gear to neutral and operate starting motor		

#### Trouble-shooting:

No signal or signal too small:

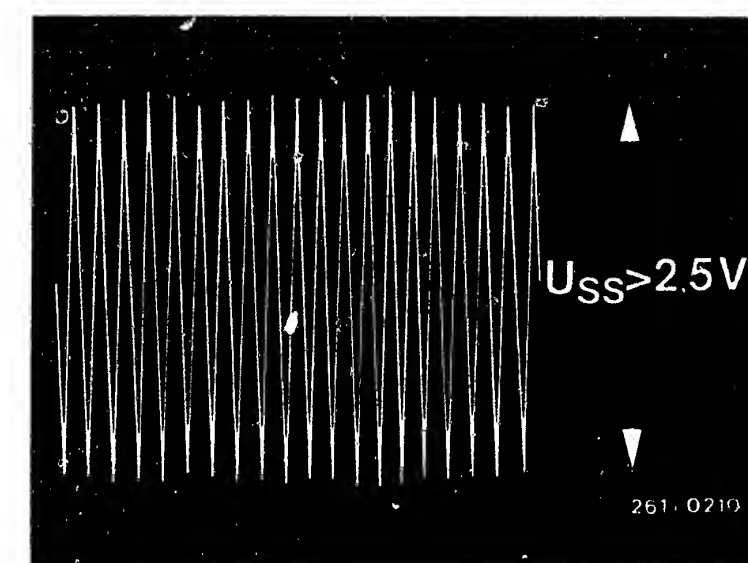
- Cranking speed below  $200 \text{ min}^{-1}$  - charge battery.
- Check nominal air gap  $a = 0.8 \text{ mm}$ :  
Remove cover plate from ring gear housing.

Continued on D3/D4



- 1 = Plug connection for engine-speed sensor with black plug  
 2 = Plug connection for reference-mark sensor with gray plug

Engine-speed sensor signal



**D1**

Testing with universal test adapter  
 BMW 6 and 7 series with elec. trans.



**D2**

Testing with universal test adapter  
 BMW 6 and 7 series with elec. trans.



## Trouble-shooting - Test step 16 (continued)

- Replace engine-speed sensor:  
Unscrew hexagon-socket-head cap screw on sensor. Remove dirt deposits on sensor.  
If necessary, apply two screwdrivers to the recesses left and right of the sensor and raise sensor.
- Incorrect signal (greatly extended in the picture):  
Heavily damaged tooth on starting motor ring gear. Replace ring gear.

Before installing the sensors, make sure that no metallic parts are sticking to the sensor (sensors contain permanent magnets). Grease sensors with Molykote Longterm 2.

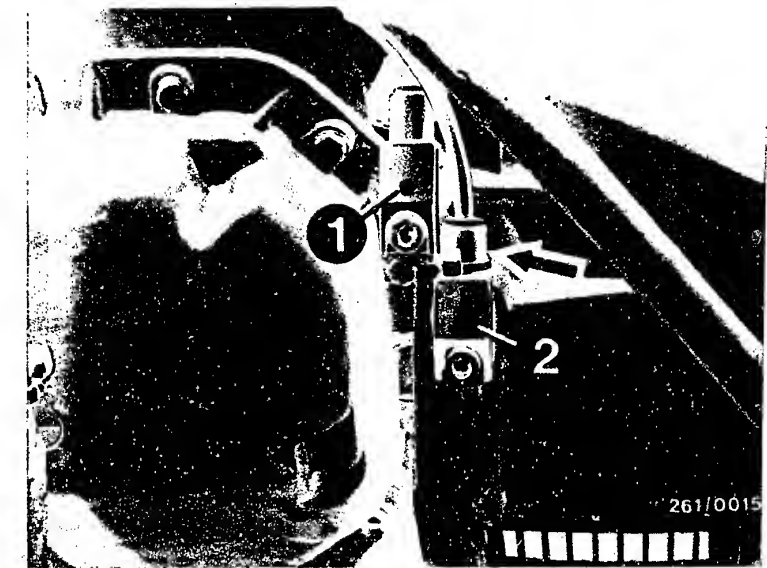
Do not mix up the sensors when installing!

Pay attention to marking: Reference-mark sensor with marking and grey plug.  
Engine-speed sensor without marking, black plug.

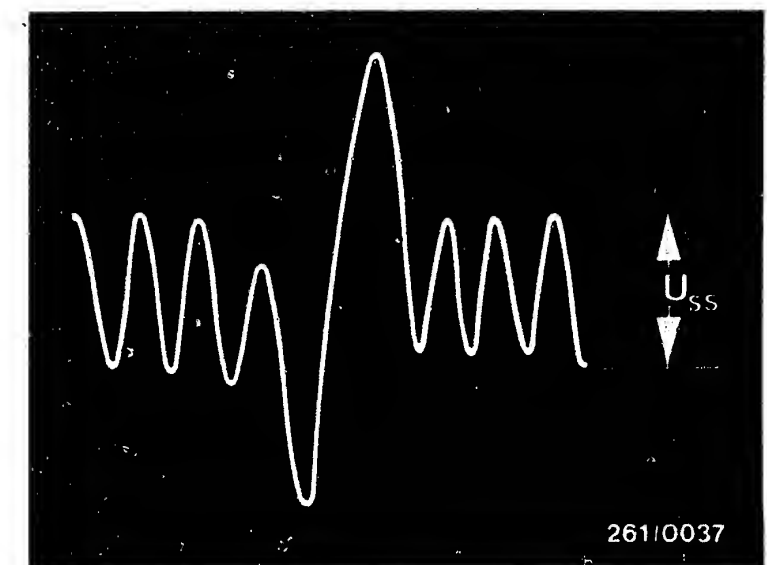
The sensors are plugged into the hole as far as they will go and secured. Do not use force when inserting.

When installing, make sure that the connectors are not mixed up.

Make sure that the spring contacts in the plug are correctly seated and latch in position. Spring contacts must not allow themselves to be pushed back.



1 = Engine-speed sensor  
2 = Reference-mark sensor  
Arrow = Identification on  
reference-mark sensor



**D3**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



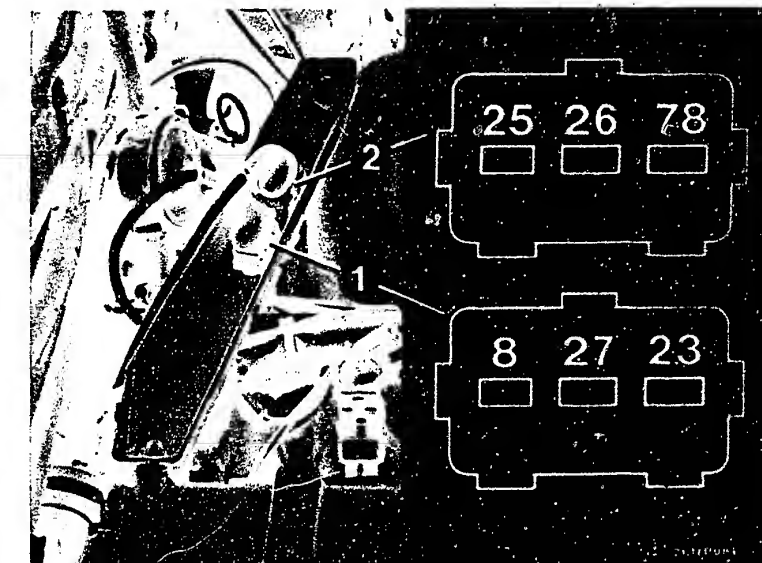
**D4**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



Test step 17		
Operation		Reading
Program switch position "V"	2	Reference-mark sensor signal present (lower illustration).
Program switch position "Ω"		
Measuring equipment: Motortester, oscilloscope	15	Automatic and manually shifted transmission Lever to left-hand stop (calibrated voltage range)
Measuring range: Special input		
Connection: Test wells; red clip to red well, black clip to black well		If reading O.K., continue testing with test step 20. (Test steps 18 and 19 deleted).
Operation in vehicle: Shift gear to neutral and operate starting motor		

Testing
Component: Reference-mark sensor
Operation: Amplitude (signal) at terminals 25 and 26
Malfunction: No signal or signal too small. Incorrect signal.



- 1 = Plug connection for reference-mark sensor with black plug  
2 = Plug connection for engine-speed sensor with gray plug

Reference-mark sensor signal

#### Trouble-shooting:

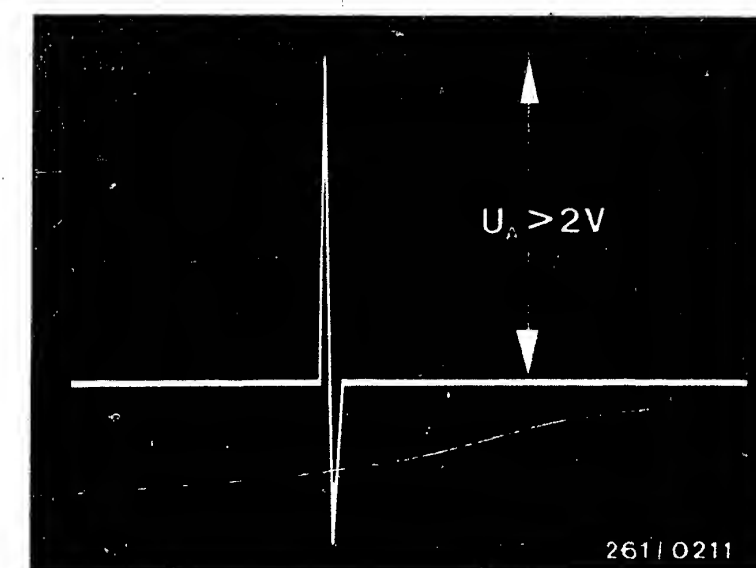
No signal or signal too small:

- Cranking speed below  $200 \text{ min}^{-1}$  - charge battery.
- Check nominal air gap  $a = 0.8 \text{ mm}$ :  
Remove cover plate from ring gear housing.  
The reference mark (3) can be brought up to the reference-mark sensor by turning the ring gear e.g. using a wrench.  
Measure the air gap (a) with feeler gauge.

#### Incorrect signal:

- Signal is incorrect if negative spike comes first. Check assignment of leads according to circuit diagram and picture opposite.

Continued on D 7/D 8



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**D5**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



**D6**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.





## Trouble-shooting - test step 17 (continued)

- Replacing the reference-mark sensor:  
Unscrew hexagon-socket-head cap screw on sensor. Remove dirt deposits on sensor.  
If necessary, apply two screwdrivers to the recesses to left and right of the sensor and raise sensor.

Before installing the sensors, make sure that no metallic parts are sticking to the sensor (sensors contain permanent magnets): Grease sensors with "Molykote Longterm 2".

Do not mix up the sensors when installing.

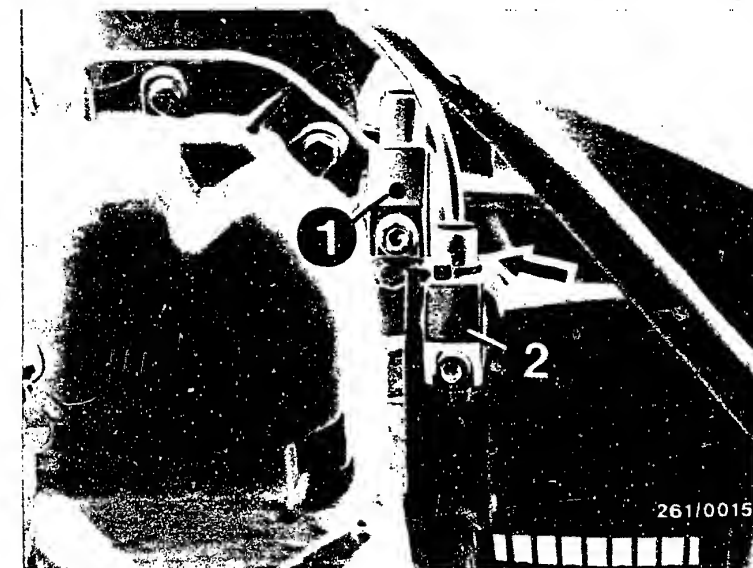
Pay attention to markings:

The reference-mark sensor is identified with "B" and a cable binder.

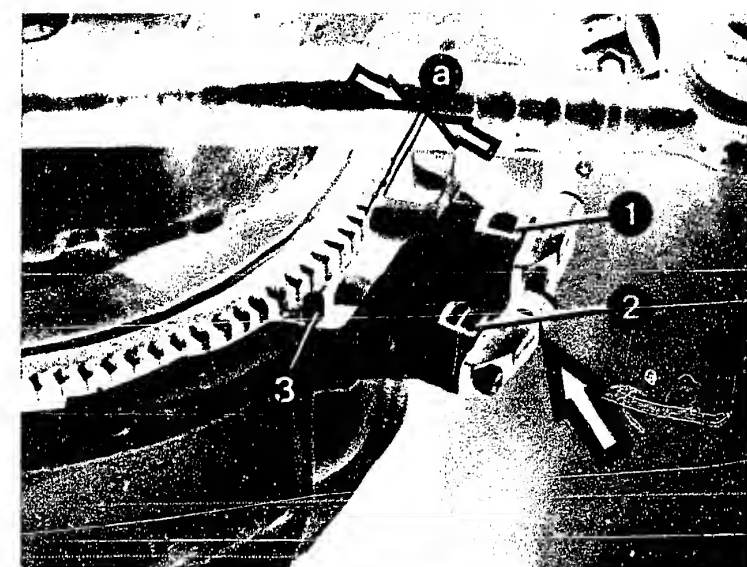
The sensors are plugged into the hole as far as they will go and secured. Do not use force when inserting.

When installing, make sure that the connectors are not mixed up.

Make sure that the spring contacts in the plug are correctly seated and latch in position. Spring contacts must not allow themselves to be pushed back.



1 = Engine-speed sensor  
2 = Reference-mark sensor  
Arrow = Identification on reference-mark sensor



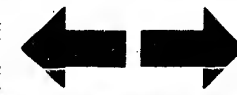
**D7**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.

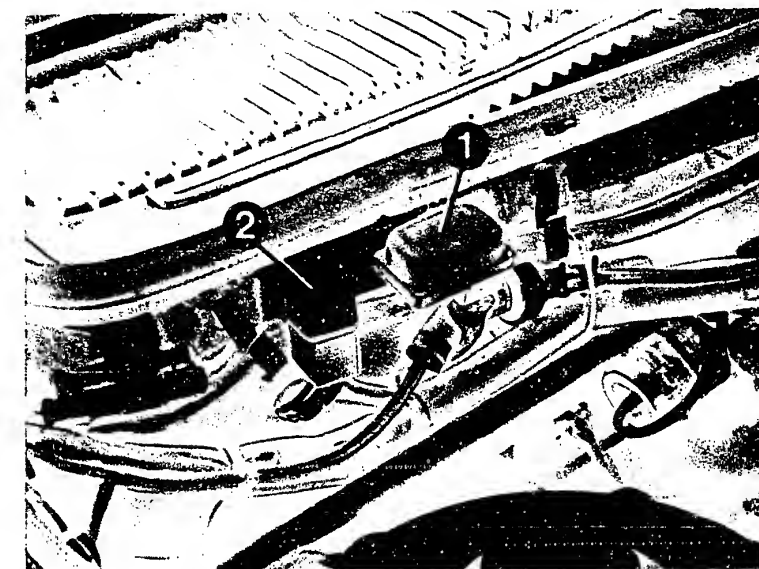


**D8**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



Test step 20		(Test steps 18 and 19 deleted)	
Operation		Reading	Testing
Program switch position "V"	6	10 ... 15 V	<u>Components:</u> Relay 2 (main relay)
Program switch position "Ω"	15		
<u>Measuring equipment:</u> Voltmeter		If reading O.K., continue testing with <u>next test step</u>	<u>Operation:</u> Supply voltage for control unit at terminals 35 (+) and 5 (ground)
<u>Measuring range:</u> 15 V			
Connection: Test sockets, (red = +, black = ground)	V		<u>Malfunction:</u> Voltage less than 10 V
<u>Operation in vehicle:</u> Switch on ignition			



1 = Altitude sensor  
 2 = Relay 2 (main relay)

#### Trouble-shooting:

1. Voltage less than 10 V: Battery insufficiently charged or high voltage drops at terminals.

2. No voltage reading: Check relay set.

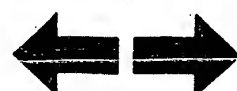
Perform the following voltage measurements at the relay with the ignition on:

- Measure battery voltage at Term. 87 (2x), Term. 86 and Term. 30.  
 Measure ground connection Term. 85 to B+ (test adapter connected).
- Check lead from relay 2 term. 87 to control unit plug term. 35.
- Check Motronic ground terminal (no. 5), also lead 5/2.

Note: If replacing relay 2, make sure that only relay with blocking diode is installed. Note symbol on relay housing.

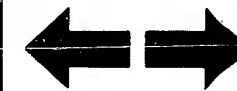
**D9**

Testing with universal test adapter  
 BMW 6 and 7 series with elec. trans.



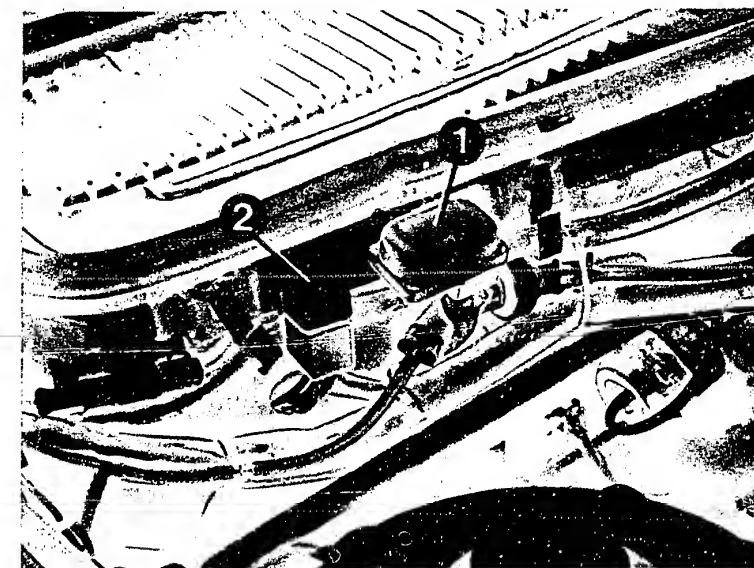
**D10**

Testing with universal test adapter  
 BMW 6 and 7 series with elec. trans.



### Test step 21

Operation		Reading	Testing
<u>Program switch position "V"</u>	7	<u>10 ... 15 V</u>	<u>Components:</u>  Relay 2 (main relay)
<u>Program switch position "Ω"</u>			
<u>Measuring equipment:</u> Voltmeter			<u>Operation:</u>  Supply voltage for control unit at terminals 18 (+) and 5 (ground)
<u>Measuring range:</u> 15 V			
<u>Connection:</u> Test sockets, (red = +, black = ground)	V		
<u>Operation in vehicle:</u> Switch on ignition		<u>Malfunction:</u> Voltage less than 10 V	



1 = Altitude sensor  
2 = Relay 2 (main relay)

### Trouble-shooting:

- Check lead from control unit plug term. 18 to relay 2 term. 87 (lead 93).

Note: If replacing relay 2, make sure that only a relay with blocking diode is installed. Note symbol on relay housing.

**D11**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



**D12**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



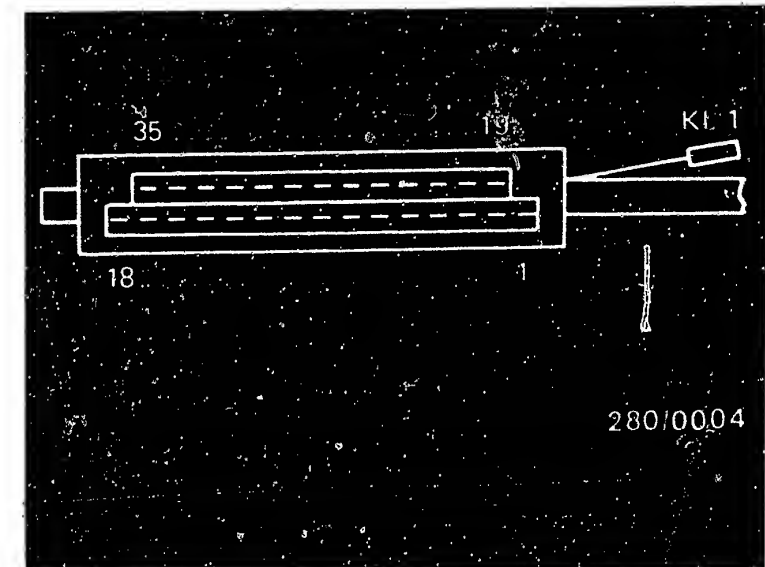


Test step 22 Ignition off. Connect control unit.			
Operation		Reading	Testing
Program switch position "V"	5	Primary signal present (lower illustration)	<u>Component:</u>  Ignition coil, H.T. ignition cables, control unit
Program switch position "Ω"	15		
<u>Measuring equipment:</u> Motortester, oscilloscope		If reading O.K., continue testing with next test step	<u>Operation:</u>  Primary signal from ignition coil terminal 1 to ground
<u>Measuring range:</u> Special input			<u>Malfunction:</u>  No signal or incorrect signal.
Connection: Test wells; red clip to red well, black clip to black well, triggering on cylinder 1			
<u>Operation in vehicle:</u> Shift gear to neutral and operate starting motor			

#### Trouble-shooting:

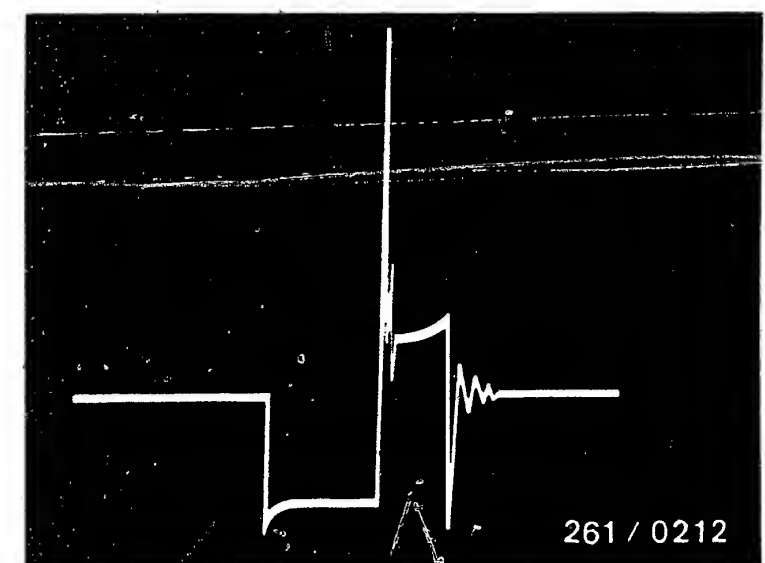
- Check Motronic ground terminals: terminals must be bare and screws must be tight.
- Check ignition coil, including leads and high-voltage leads, together with plug connection to control unit plug term. 1. Spring contact on control unit plug term. 1 must not be able to be pushed back.
- Check lead from ignition coil term. 15 to ignition lock term. 15.
- Replace control unit.

Note: To rule out any confusion between the two 35-pin plugs, in addition to the mechanical locking device the plugs are identified differently. The Motronic plug has a green cable binder.



To view of 35-pin control unit plug (black) from Motronic wiring harness term. 1 = plug connection to tachometer

Primary signal



**D13**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



**D14**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



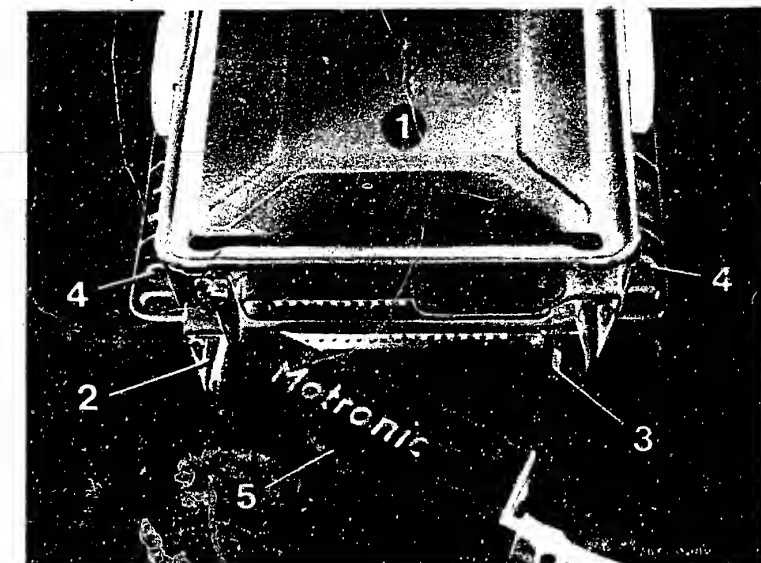
Test step 23			
Operation		Reading	Testing
Program switch position "V"	8	Greater than 8 V	<u>Component:</u>  Control unit
Program switch position "Ω"	15		
<u>Measuring equipment:</u> Voltmeter			<u>Operation:</u>  Supply voltage for air-flow sensor at terminal 9 and ground
<u>Measuring range:</u> 15 V			
<u>Connection:</u> Test sockets, (red = +, black = Ground)	V	If reading O.K., continue testing with <u>next test step</u>	<u>Malfunction:</u>  Voltage less than 8 V
<u>Operation in vehicle:</u> Switch on ignition			

#### Trouble-shooting:

- Check contacting at control unit. It must not be possible to push back the spring contacts.
- Replace control unit.

#### Note

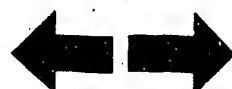
To rule out any confusion between the two 35-pin plugs, in addition to the mechanical locking device the plugs are identified differently. The Motronic plug has a green cable binder.



- 1 = Control unit
- 2 = Locating lug
- 3 = Detent
- 4 = Mounting hole
- 5 = Motronic plug

**D15**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



**D16**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



Test step 24		
Operation	Reading	Testing
Program switch position "V" 9	<u>150...250 mV</u> with air-flow sensor flap closed. Remove hose from air-flow sensor on air filter side and open sensor flap by hand. Sensor flap must not catch and must return automatically to its rest position when released. With the sensor flap fully open the reading rises to above 7 V (change to different measuring range). If reading O.K., continue testing with test step 27. Test steps 25 and 26 deleted.	<u>Component:</u> Air-flow sensor
Program switch position "Ω" 15		
Measuring equipment: Voltmeter		<u>Operation:</u> Divider voltage at terminal 7 and ground
Measuring range 1.5 V		
Connection: Test sockets (red = +, black = ground) V		<u>Malfunction:</u> No voltage or voltage too low
Operation in vehicle: Switch on ignition		

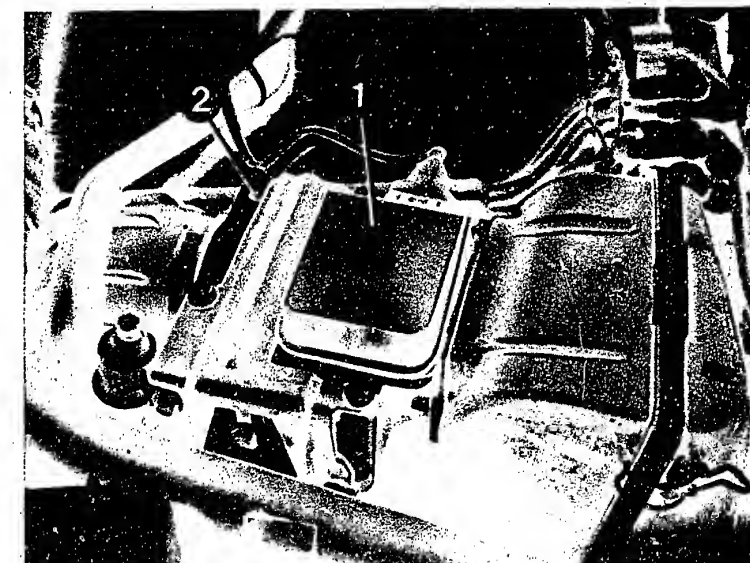
#### Trouble-shooting:

##### No reading:

- Check leads from air-flow sensor term. 6,7 and 9 to control unit plug term. 6, 7 and 9.
- Spring contacts must not allow themselves to be pushed back.

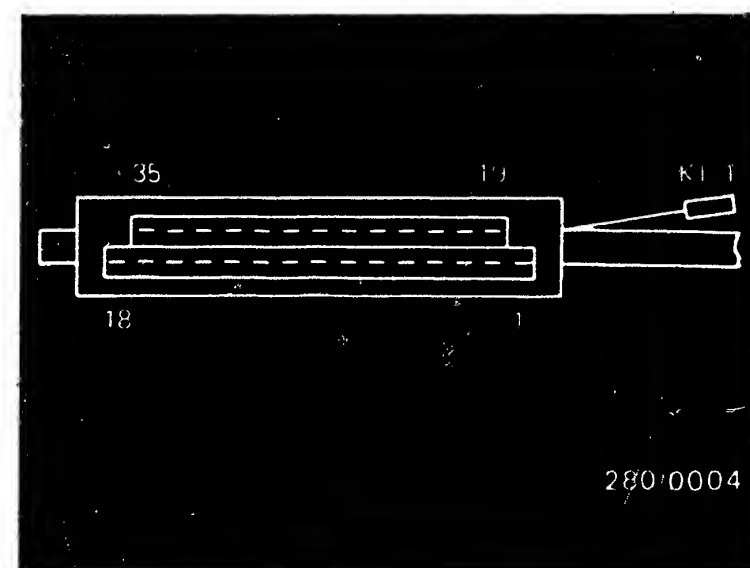
##### Reading outside tolerance:

- Check whether air-flow sensor flap is closing fully.
- Replace air-flow sensor.



- 1 = Air-flow sensor with NTC I  
 2 = Idle-mixture-adjusting screw

To view of 35-pin control unit plug (black) from Motronic wiring harness term. 1 = plug connection to tachometer



**D17**

Testing with universal test adapter  
 BMW 6 and 7 series with elec. trans.



**D18**

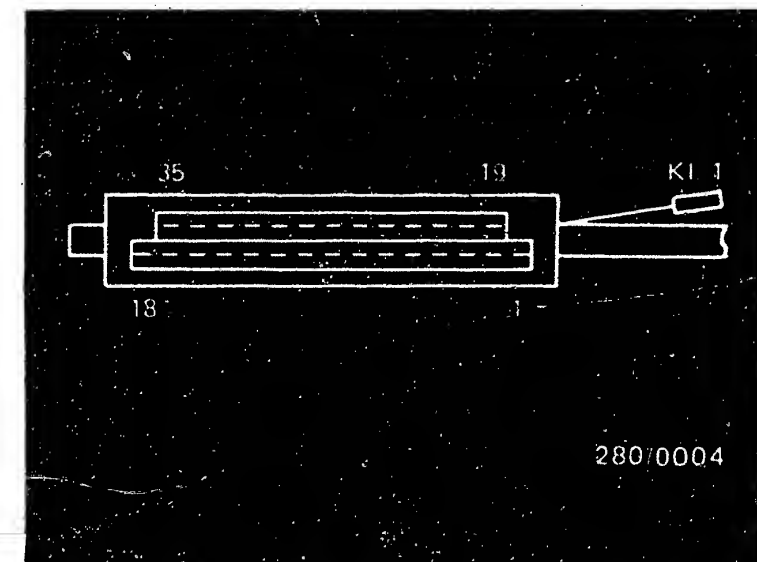
Testing with universal test adapter  
 BMW 6 and 7 series with elec. trans.



Test steps 25 and 26 deleted!

### Test step 27

Operation		Reading	Testing
Program switch position "V"	12	8...15 V while cranking	<u>Component:</u>  Lead 4 from starting motor term. 50 to control unit plug term. 4
Program switch position "Ω"	15		
<u>Measuring equipment:</u> Voltmeter			
<u>Measuring range:</u> 15 V		If reading O.K., continue testing with <u>next test step</u>	<u>Operation:</u>  Voltage test at terminal 4
Connection: Test sockets (red = +, black = ground)	V		
<u>Operation in vehicle:</u> Shift gear to neutral and operate starting motor.			
			<u>Malfunction:</u>  Voltage less than 8 V or, with engine running, greater than 15 V



To view of 35-pin control unit plug  
(black) from Motronic wiring harness  
term. 1 = plug connection to  
tachometer

### Trouble-shooting:

#### 1. Voltage less than 8 V:

- Test voltage drop at starting motor terminal 50.
- Check lead from control unit plug terminal 4 to starting motor terminal 50.

#### 2. Voltage greater than 15 V with engine running:

Check alternator and regulator.

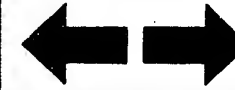
**D 19**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



**D 20**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



# Test step 28

## Operation

Program switch position "V"

13

Program switch position "Q"

15

## Measuring equipment:

Motortester, oscilloscope

## Measuring range:

Special input

Connection: Test wells; red clip to red well, black clip to black well

## Operation in vehicle:

Shift gear to neutral and operate starting motor

## Reading

Dwell-period signal present (lower illustration)

If reading O.K., continue testing with next test step

## Testing

### Component:

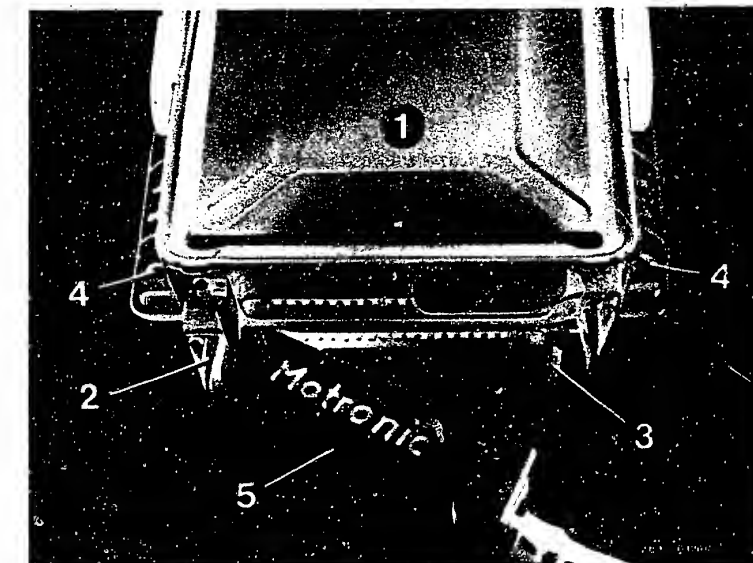
Control unit

### Operation:

Dwell-period signal at terminal 21 and ground

### Malfunction:

No signal



- 1 = Control unit
- 2 = Locating lug
- 3 = Detent
- 4 = Mounting hole
- 5 = Motronic plug

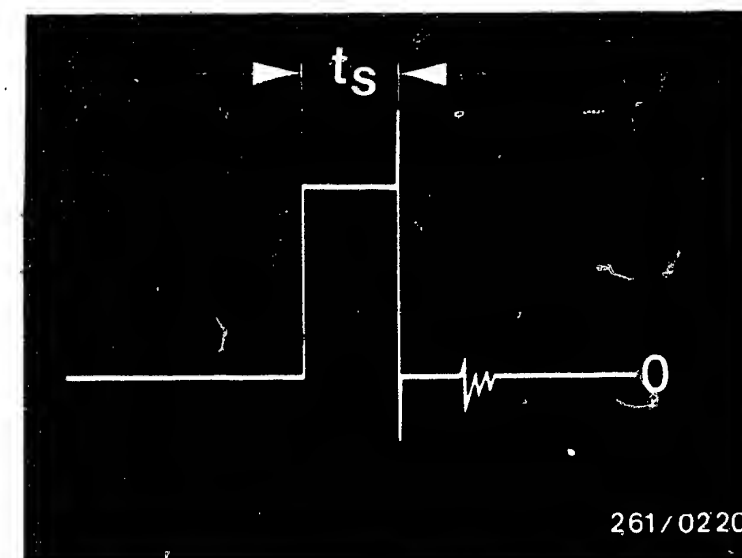
$t_s$  = Dwell period  
0 = Zero line

## Trouble-shooting:

- Replace control unit

## Note:

To rule out any confusion between the two 35-pin plugs, in addition to the mechanical locking device the plugs are identified differently. The Motronic plug has a green cable binder.



261/0220

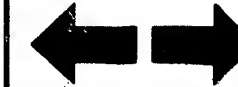
D21

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.

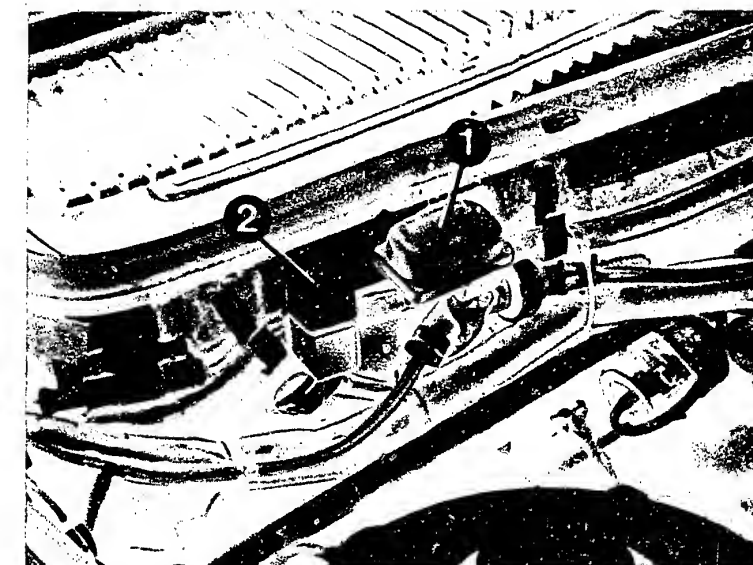


D22

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.

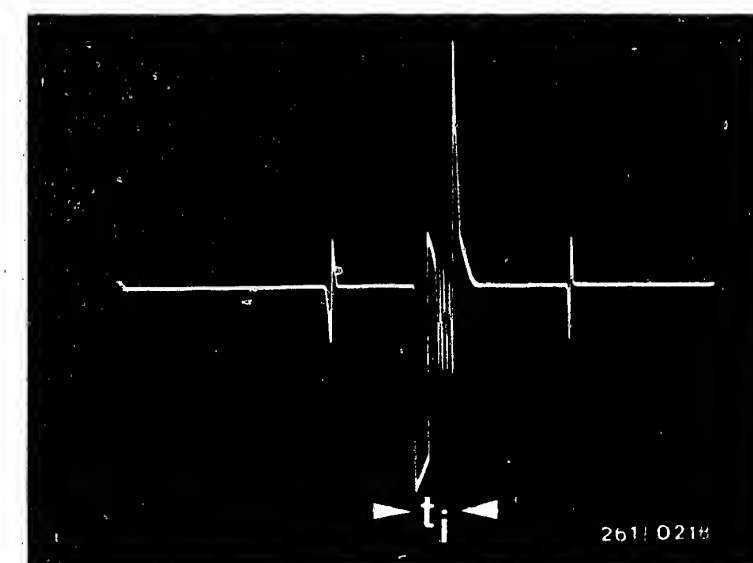


Test step 29			
Operation		Reading	Testing
Program switch position "V"	14	Injection signal present (lower illustration)	<u>Component:</u>  Power supply for solenoid-operated injection valves, control unit
Program switch position "Q"	15		
<u>Measuring equipment:</u> Motortester, oscilloscope			<u>Operation:</u>  Injection output stage at terminal 14 and ground
<u>Measuring range:</u> Special input			
<u>Connection:</u> Test wells; red clip to red well, black clip to black well			
<u>Operation in vehicle:</u> Shift gear to neutral and operate starting motor		Watch for interference (disturbance pulses).  If reading O.K., continue testing with next test step	<u>Malfunction:</u>  No signal



1 = Altitude sensor  
2 = Relay 2 (main relay)

Injection signal  
 $t_i$  = Duration of injection



#### Trouble-shooting:

- Test power supply to injection valves:  
Remove connector from all injection valves. Measure voltage at both terminals of valve connectors. Battery voltage must be measured at each valve connector. If no voltage, check lead from valve connector to relay 2 term. 87.
- Check lead from control unit plug term. 14 to the solenoid-operated injection valves for cylinders 1, 2 and 3.
- Replace control unit.

#### Note:

To rule out any confusion between the two 35-pin plugs, in addition to the mechanical locking device the plugs are identified differently. The Motronic plug has a green cable binder.

**D23**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



**D24**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.





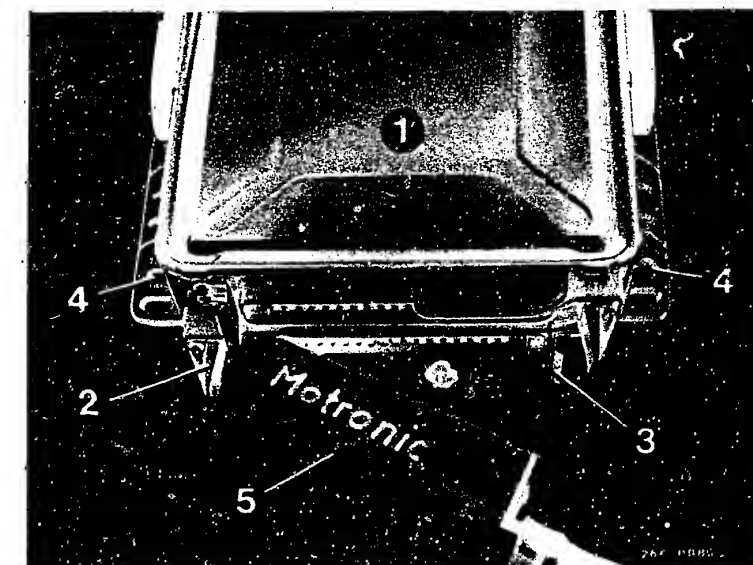
<u>Test step 30</u>		<u>Reading</u>	<u>Testing</u>
<u>Operation</u>			
<u>Program switch position "V"</u>	14	Duration of injection $t_i$ becomes slightly longer after pressing button T1 (NTC II, cold). <u>Only press T1 briefly:</u>	<u>Component:</u>  Control unit
<u>Program switch position "Ω"</u>	15		
<u>Measuring equipment:</u> Motortester, oscilloscope			
<u>Measuring range:</u> Special input			
<u>Connection:</u> Test wells; red clip to red well, black clip to black well			
<u>Operation in vehicle:</u> Shift gear to neutral and operate starting motor			
<u>Button:</u> Press T1			
			<u>Operation:</u>  Influence of temperature
			<u>Malfunction:</u>  Signal does not become wider after pressing button T1

#### Trouble-shooting:

Replace control unit

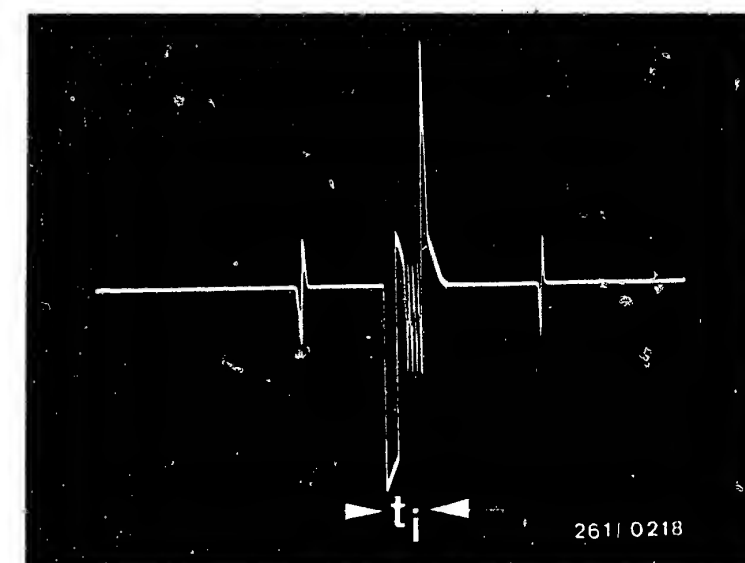
#### Note:

To rule out any confusion between the two 35-pin plugs, in addition to the mechanical locking device the plugs are identified differently. The Motronic plug has a green cable binder.



- 1 = Control unit
- 2 = Locating lug
- 3 = Detent
- 4 = Mounting hole
- 5 = Motronic plug

Injection signal  
 $t_i$  = Duration of injection



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**E1**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



**E2**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



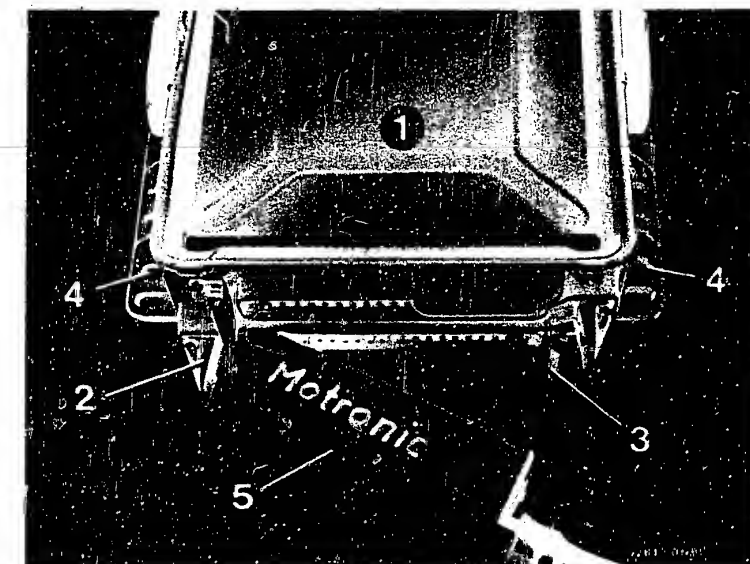
Test step 31		Reading	Testing
Operation			
<u>Program switch position</u> "V"	15	Injection signal present (lower illustration)	<u>Component:</u>  Control unit
<u>Program switch position</u> "Ω"	15		
<u>Measuring equipment:</u> Motortester, oscilloscope			<u>Operation:</u>  Injection output stage at terminal 15 and ground
<u>Measuring range:</u> Special input			
<u>Connection:</u> Test wells; red clip to red well, black clip to black well			<u>Malfunction:</u>  No signal
<u>Operation in vehicle:</u> Shift gear to neutral and operate starting motor			
		If reading O.K., continue testing with next test step	

#### Trouble-shooting:

- Test power supply to injection valves:  
Remove connector from all injection valves. Measure voltage at both terminals of valve connectors. Battery voltage must be measured at each valve connector. If no voltage, check lead from valve connector to relay 2 term. 87.
- Check lead from control unit plug term. 15 to the solenoid-operated injection valves for cylinders 4, 5 and 6.
- Replace control unit.

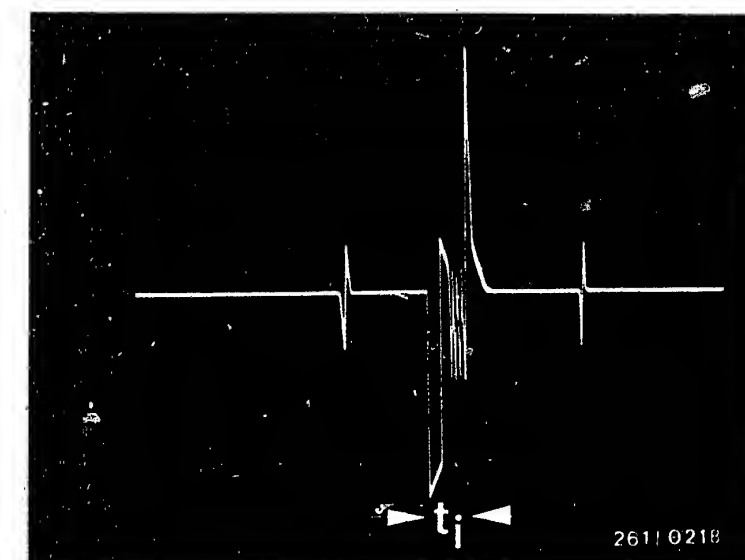
#### Note:

To rule out any confusion between the two 35-pin plugs, in addition to the mechanical locking device the plugs are identified differently. The Motronic plug has a green cable binder.



- 1 = Control unit
- 2 = Lug
- 3 = Detent
- 4 = Mounting holes
- 5 = Motronic plug

Injection signal  
 $t_i$  = Duration of injection



**E3**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



**E4**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.





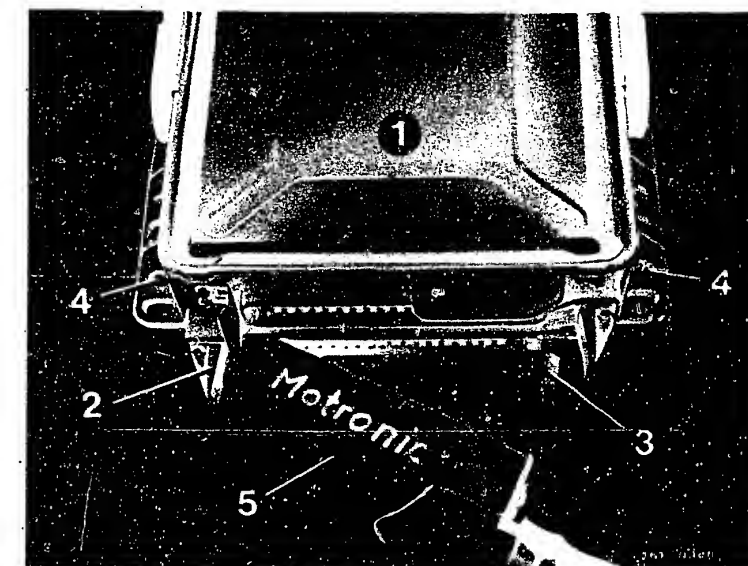
<u>Test step 32</u>			
<u>Operation</u>		<u>Reading</u>	<u>Testing</u>
<u>Program switch position</u> "V"	16	Injection signal (measuring output) present (lower illustration)	<u>Component:</u>  Control unit
<u>Program switch position</u> "Ω"	15		
<u>Measuring equipment:</u> Motortester, oscilloscope			<u>Operation:</u>  Injection signal at terminal 11 and ground
<u>Measuring range:</u> Special input			
<u>Connection:</u> Test wells; red clip to red well, black clip to black well			<u>Malfunction:</u>  No signal
<u>Operation in vehicle:</u> Shift gear to neutral and operate starting motor		If reading O.K., continue testing with <u>next test step</u>	

#### Trouble-shooting:

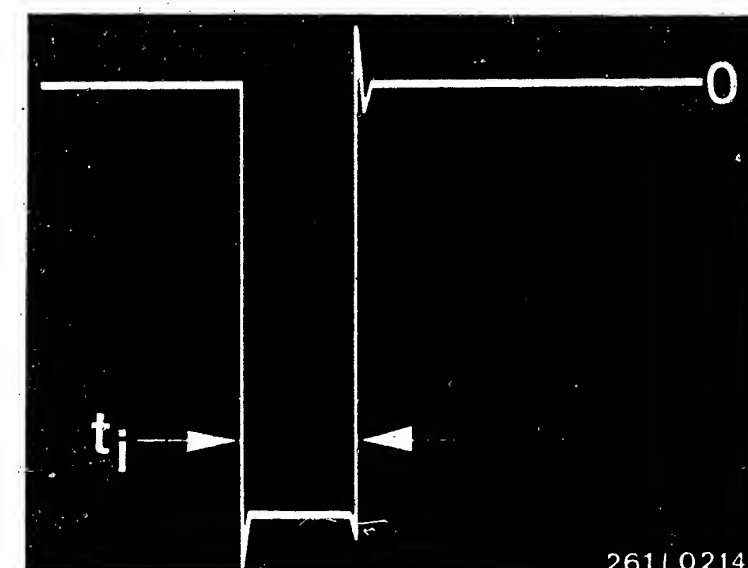
Replace control unit.

#### Note:

To rule out any confusion between the two 35-pin plugs, in addition to the mechanical locking device the plugs are identified differently. The Motronic plug has a green cable binder.



- 1 = Control unit
- 2 = Locating lug
- 3 = Detent
- 4 = Mounting hole
- 5 = Motronic plug



261/0214

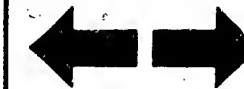
**E5**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



**E6**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



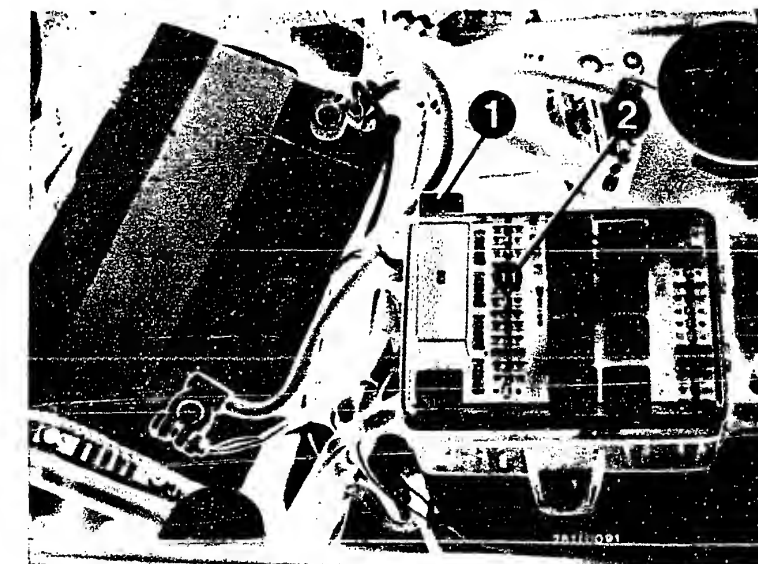
Test step 33		Plug in pump relay.	
Operation		Reading	Testing
Program switch position "V"	17	10...15 V	Component:  Relay 1 (pump relay)
Program switch position "Ω"	15		Operation:  Voltage at Term. 20 to ground
Measuring equipment': Voltmeter			
Measuring range: 15 V		If reading O.K., continue testing with next test step	Malfunction:  Voltage less than 10 V
Connection: Test sockets; (red = +, black = ground)	V		
Operation in vehicle: Ignition on			

#### Trouble-shooting:

- Check pump relay 1 (coil winding).
- Check leads 20 and 46 including plug-in connections.
- Replace control unit.

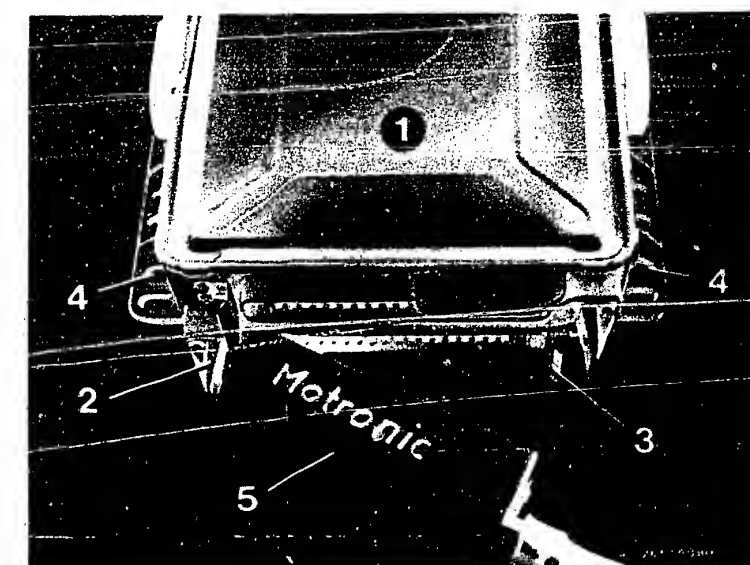
#### Note:

To rule out any confusion between the two 35-pin plugs, in addition to the mechanical locking device the plugs are identified differently. The Motronic plug has a green cable binder.



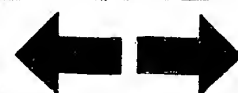
- 1 = Relay (pump relay)  
2 = Pump fuse (no. 11)

- 1 = Control unit  
2 = Locating lug  
3 = Detent  
4 = Mounting hole  
5 = Motronic plug



**E7**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.

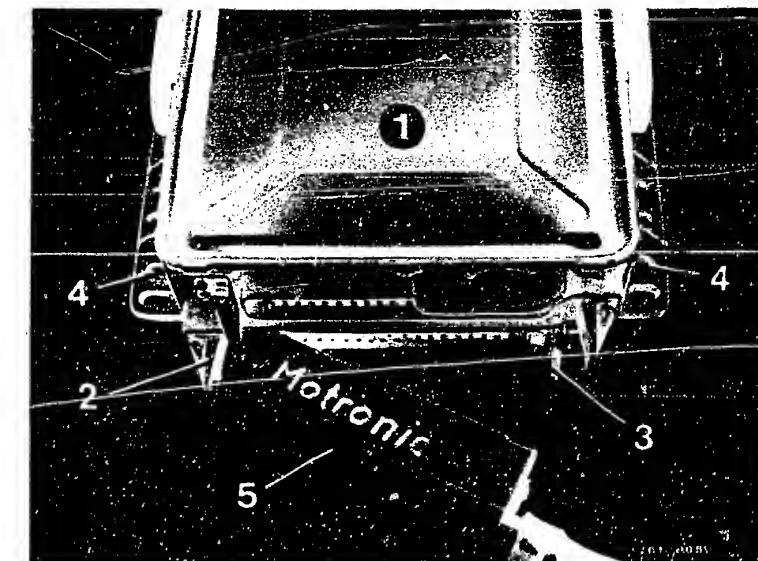


**E8**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



Test step 34			
Operation		Reading	Testing
Program switch position "V"	17	<u>max. 4 V</u>	<u>Component:</u>  Control unit
Program switch position "Ω"	15		
<u>Measuring equipment:</u> Voltmeter			<u>Operation:</u>  Pump control Term. 20 to ground
<u>Measuring range:</u> 15 V			
Connection: Test sockets; (red = +, black = ground)	V		
<u>Operation in vehicle:</u> Shift gear to neutral and operate starting motor		<u>If reading O.K., continue testing with next test step</u>	<u>Malfunction:</u>  Voltage greater than 4 V



- 1 = Control unit
- 2 = Lug
- 3 = Detent
- 4 = Mounting holes
- 5 = Motronic plug

#### Trouble-shooting:

Replace control unit.

#### Note:

To rule out any confusion between the two 35-pin plugs, in addition to the mechanical locking device the plugs are identified differently. The Motronic plug has a green cable binder.

**E9**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



**E10**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



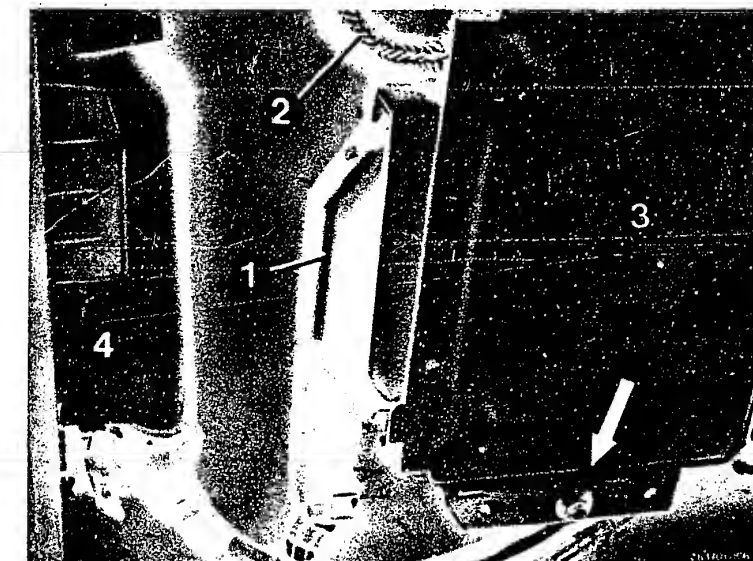
Test step 35			
<u>Operation</u>		<u>Reading</u>	<u>Testing</u>
<u>Program switch position "V"</u>	13	Dwell-period signal present after knock-control unit (lower illustration)	<u>Component:</u> Knock control unit
<u>Program switch position "Ω"</u>	15		
<u>Measuring equipment:</u> Motortester, oscilloscope			<u>Operation:</u>  Dwell-period signal at terminal 24 and ground
<u>Measuring range:</u> Special input			
<u>Connection:</u> Test wells; red clip to red well, black clip to black well			<u>Malfunction:</u>  No signal
<u>Operation in vehicle:</u> Shift gear to neutral and operate starting motor		If reading O.K., continue testing with <u>next test step</u>	

#### Trouble-shooting:

- Knock-control testing is described on a special microcard.

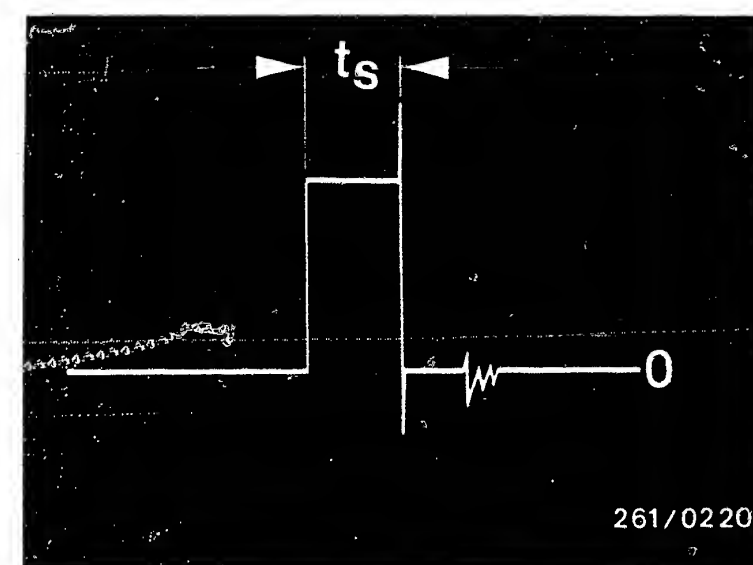
#### Note:

In order to rule out any confusion between the control units of the various systems, a mechanical locking device has been introduced. The "locating lug" (pivot point when opening and connecting the control unit) and the corresponding mounting point on the control unit have matching recesses and pins



- 1 = Plug for knock control unit
- 2 = Vacuum hose
- 3 = Knock control unit
- 4 = ABS control unit
- Arrow = Fastening screw

$t_s$  = Dwell period  
0 = Zero line



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**E11**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



**E12**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.

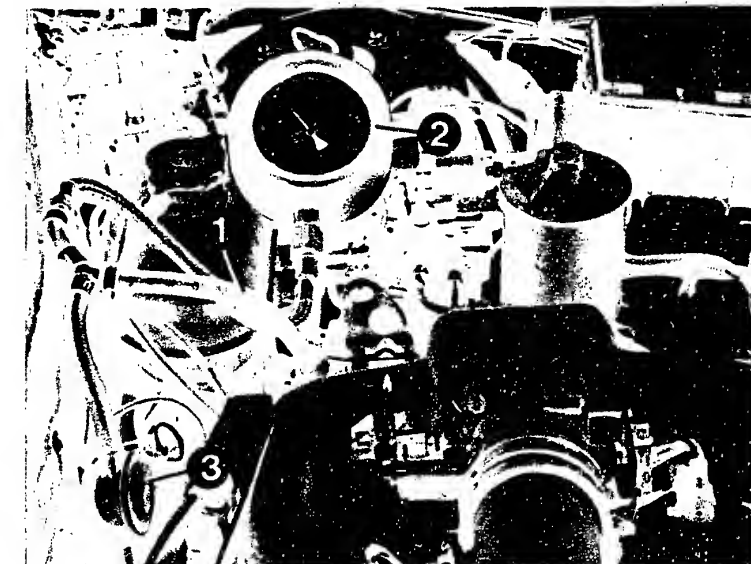


<u>Test step 36</u> <u>Switch off ignition. Connect pressure gauge.</u>			
<u>Operation</u>		<u>Reading</u>	<u>Testing</u>
<u>Program switch position</u> "V"	17	<u>2.8 to 3.2 bar</u>  745i: <u>2.3 to 2.7 bar</u>	<u>Component:</u>  Pump relay, fuel pump, pressure regulator, fuel filter
<u>Program switch position</u> "Ω"	15		
<u>Measuring equipment:</u> Pressure gauge		<u>If reading O.K., continue testing with next test step</u>	<u>Operation:</u>  Fuel pressure
<u>Measuring range:</u> 0 to 6 bar			
<u>Connection:</u> In fuel-pressure line			
<u>Operation in vehicle:</u> Switch on ignition			
<u>Button:</u> Press T3			
			<u>Malfunction:</u>  No fuel pressure or pressure outside tolerance

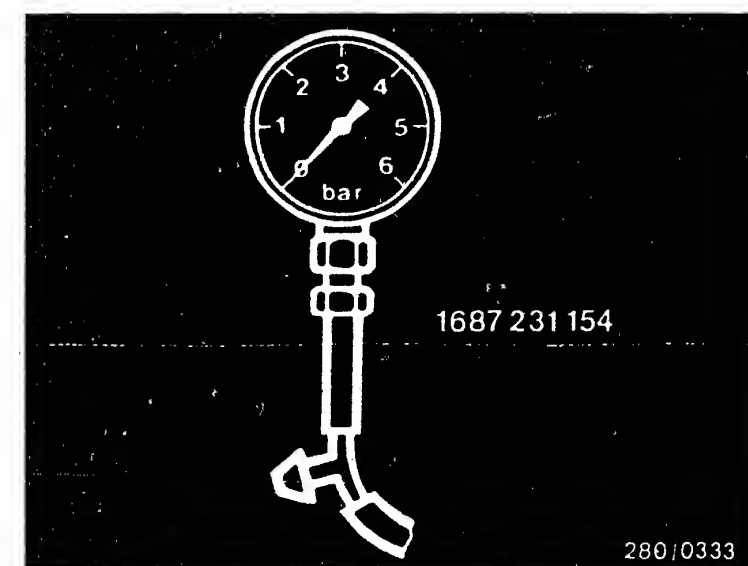
Note:

Mount pressure gauge (2) on fuel-distribution pipe (delivery line).  
Catch any escaping gasoline. Danger of fire with hot engine and  
electric sparks

Continued on E 15/E 16



- 1 = Fuel delivery line
- 2 = Pressure gauge
- 3 = Fuel-line-pressure damper



1687 231 154

280/0333

**E13**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



**E14**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



### Test step 36 continued

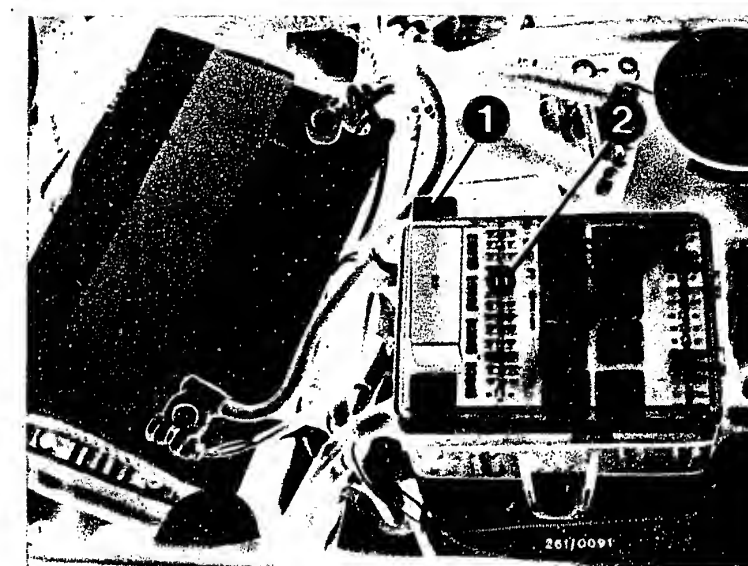
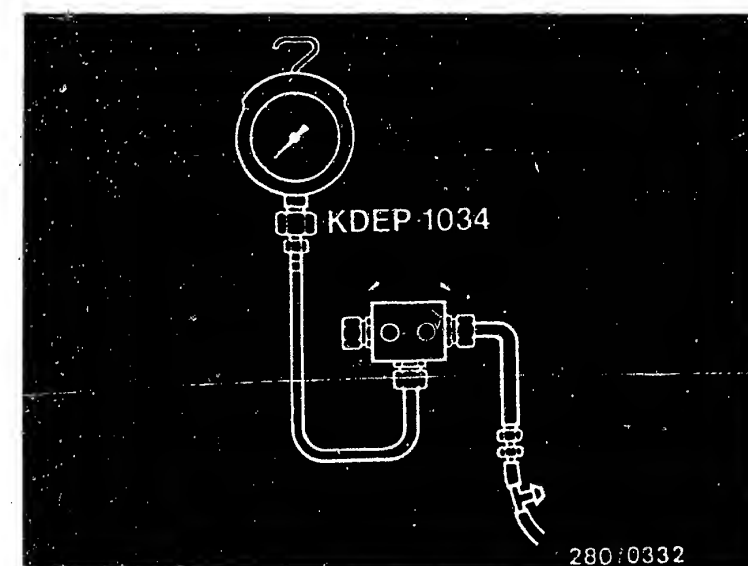
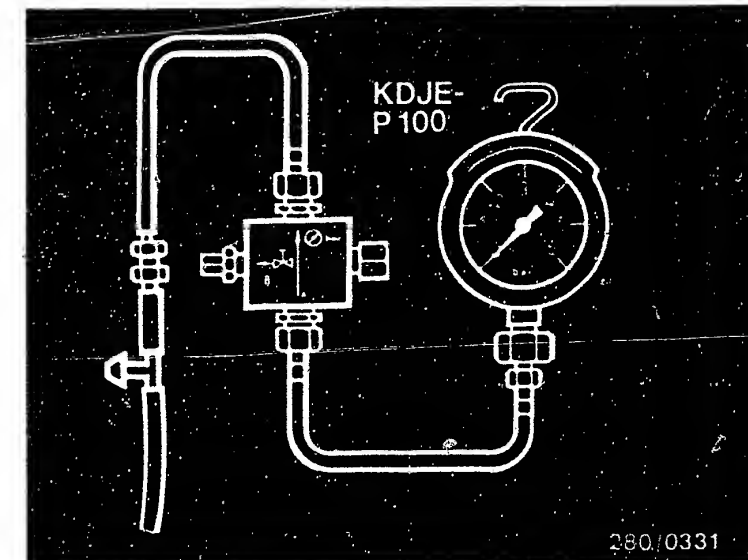
If using pressure tester KDJE-P 100 close the hollow screw.  
The end of the hose is plugged onto the fuel-distribution pipe, and  
the free Y-piece is plugged onto the fuel-delivery hose.  
Make sure there are no leaks.  
Switch on ignition. Press button T 3 to measure pressure.

### Trouble-shooting for test step 36

#### 1. Pressure 0 bar, no pumping noises can be heard:

- Test pump fuse (2).
- Replace relay 2 (pump relay) (1).

Continued on E17/E18



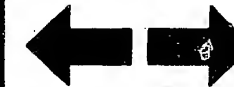
**E15**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



**E16**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.





## Trouble-shooting for TEST STEP 36 (continued)

- Measure voltage at disconnected pump plug.

No voltage:

Check lead from fuel pump to relay 2 term. 87b as well as pump ground lead.

- Voltage present:

Test pressure regulator and fuel pump, as described in 2. below.

### 2. Pressure outside tolerance, fuel pump operating:

- Fuel pressure too low:

Slowly pinch off return line with hose clammer. Pressure rises above 4 bar  
→ replace pressure regulator.

Pressure remains below 4 bar → replace fuel pump.

- Check fuel line and fuel filter for throughflow. Fuel lines pinched?

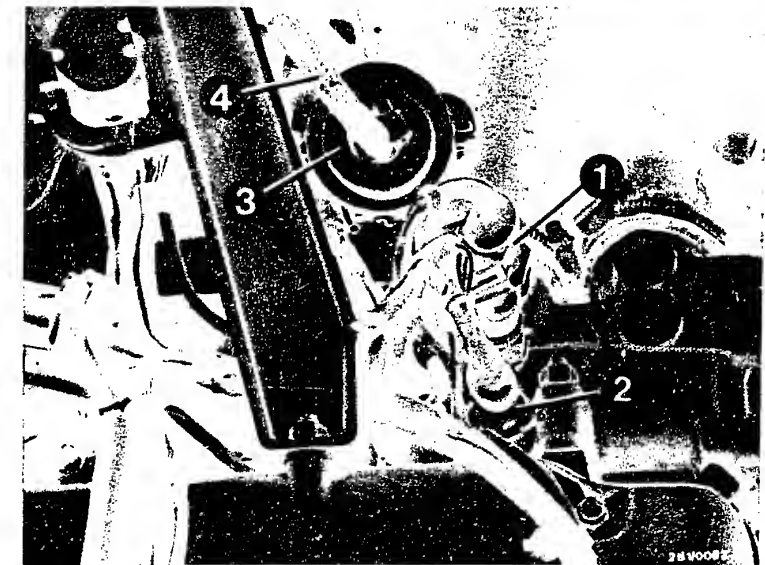
- Strainer in tank clogged

- Corrosion in tank

### 3. Fuel pressure above 2.7 or 3.2 bar

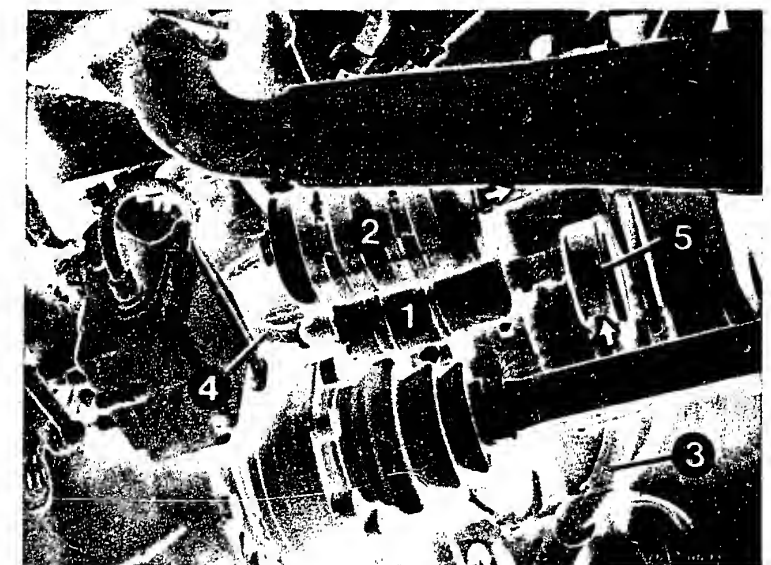
- Fuel return line clogged or pinched.

- Replace pressure regulator.



- 1 = Thermo-time switch
- 2 = Engine temperature sensor (NTC II)
- 3 = Pressure regulator
- 4 = Return hose

- 1 = Electric fuel pump
- 2 = Fuel filter
- 3 = Fuel intake line
- 4 = Fuel delivery line
- Arrows = Direction of fuel flow
- 5 = Fuel spinner



**E17**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



**E18**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



### CAUTION!

The following test steps can only be performed with the engine running.  
If the engine will not run, continue with the trouble-shooting program of your choice.  
Detailed trouble-shooting - see B3 - B4  
Direct trouble-shooting - See B5 - B10  
For further trouble-shooting, leave the test adapter, control unit and pressure gauge connected.

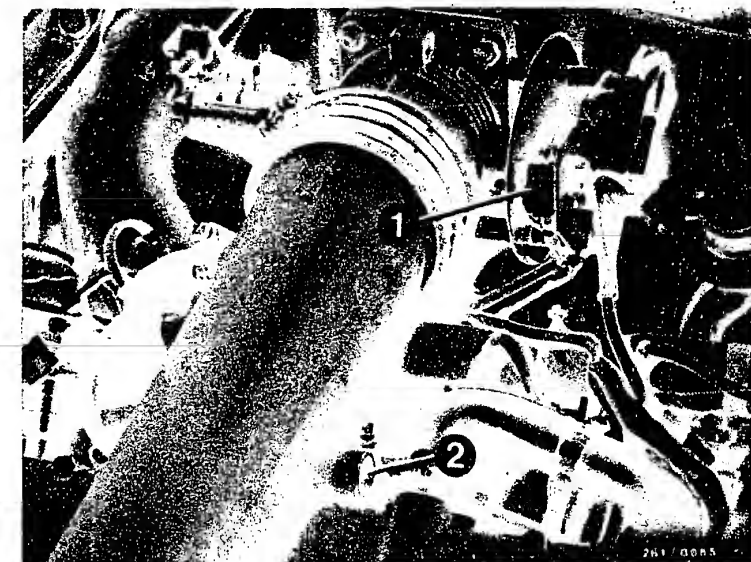
### Test step 37 Connect motortester and CO analyzer

Operation		Reading	Testing
Program switch position "V"	17	1. With engine at normal operating temperature: Idle speed: 750...850 min <sup>-1</sup>	<u>Component:</u>  Engine, leaks in air-intake system
Program switch position "Ω"	15	Japan: 800 ... 900 min <sup>-1</sup> CO concentration: 1.0 ... 1.5 vol. %CO S/CH: 0.6 ... 1.0 vol. %CO Japan: 0.45...0.65 vol. %CO For Japan version: measurement before catalytic conv.) 2. Press key T2: values must not change!	
<u>Measuring equipment:</u> Motortester and CO analyzer			<u>Operation:</u>  Idle speed and exhaust
<u>Measuring range:</u> Engine speed and CO			
<u>Connection:</u> Ignition coil (with cat. converter, plug in exhaust manifold)			<u>Malfunction:</u>  Readings outside tolerance
<u>Operation in vehicle</u> Allow engine to reach operating temperature		If reading OK, continue testing with next test step.	

### Trouble-shooting:

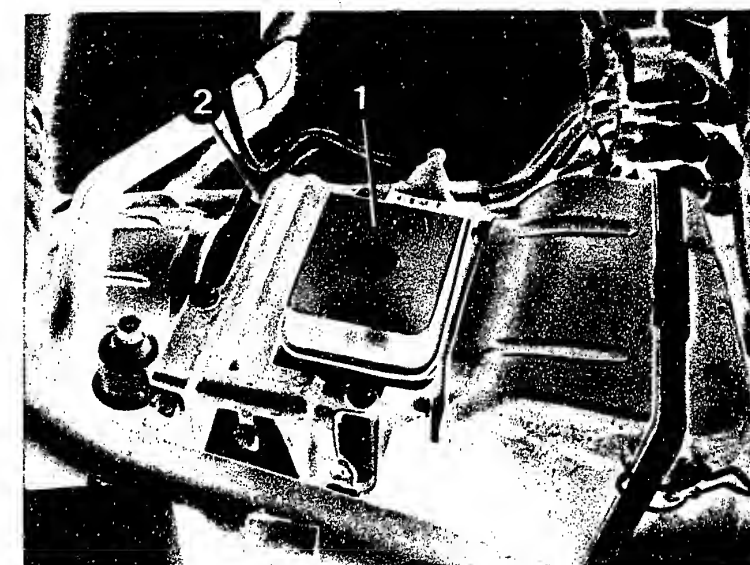
- Adjust idle speed at idle-speed-adjusting screw in throttle-valve assembly.

Continued on E 21/E 22



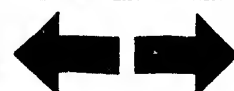
1 = Microswitch  
2 = Idle-speed-adjusting screw

1 = Air-flow sensor with NTC I  
2 = Idle-mixture-adjusting screw



E19

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



E20

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.





### Trouble-shooting - test step 37 (continued)

- Set exhaust gas with idle-mixture-adjusting screw (hexagon socket head AF5) in air-flow sensor.

To do this, remove the plug in the air-flow sensor. After finishing the adjustment, use a new plug (red).

Turning the idle-mixture-adjusting screw in a clockwise direction:

Increases the CO concentration.

Turning the idle-mixture-adjusting screw in a counterclockwise direction:

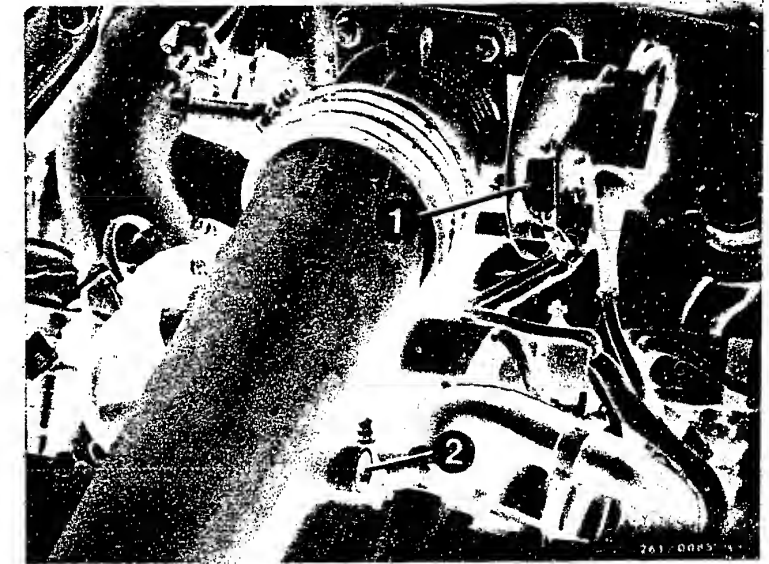
Reduces the CO concentration.

Exhaust-gas value too small and no longer adjustable:

Check intake side and exhaust system for leaks (fresh air) by means of pressure test.

#### Concerning 2.

If the readings change after pressing button T2, the engine is not yet at normal operating temperature.

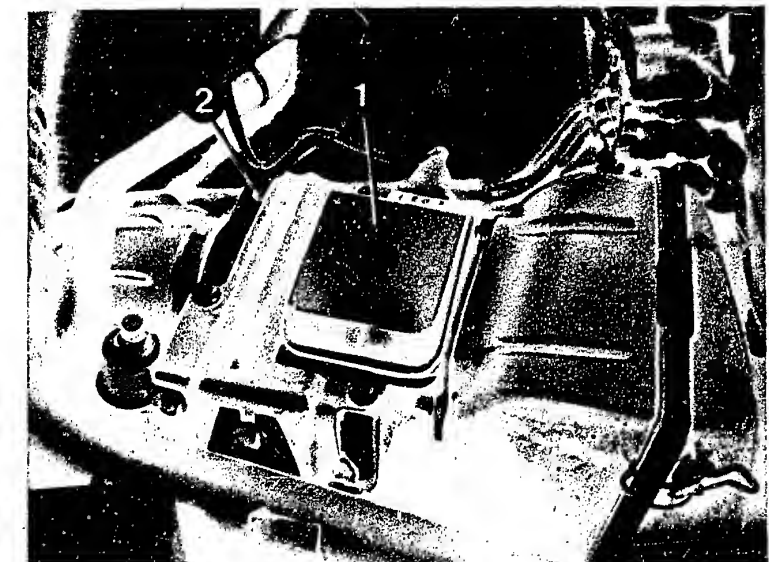


1 = Microswitch

2 = Idle-speed-adjusting screw

1 = Air-flow sensor with NTC 1

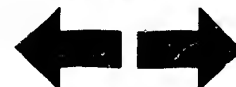
2 = Idle-mixture-adjusting screw



**E21**

Testing with universal test adapter

BMW 6 and 7 series with elec. trans.



**E22**

Testing with universal test adapter

BMW 6 and 7 series with elec. trans.



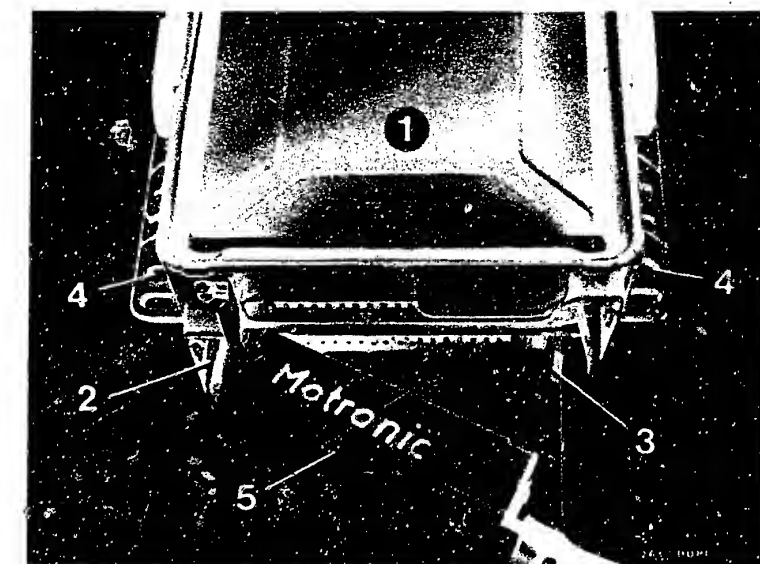
Test step 38			
Operation		Reading	Testing
Program switch position "V"	17	1. With engine at normal operating temperature and at idle speed: <u>7 ... 17°</u> Japan: <u>2 ... 12°</u>	<u>Component:</u>  Control unit
Program switch position "Q"	15		
<u>Measuring equipment:</u> Motortester		2. Press button T6 (full load) and increase engine speed to 2400 min <sup>-1</sup> :  <u>13 ... 23°</u> Japan: <u>7 ... 17°</u>	<u>Operation:</u>  Spark advance at idle and at full load
<u>Measuring range:</u> Spark advance			
<u>Connection:</u> Diagnostic cable			
<u>Operation in vehicle:</u> Allow engine to reach operating temperature.		If reading O.K., continue testing with <u>next test step</u>	<u>Malfunction:</u>  Spark advance outside tolerance

#### Trouble-shooting:

- Re 1: Carefully check idle speed again and repeat test step.  
Idle speed must be between 750 and 850 min<sup>-1</sup> or 800 and 900 min<sup>-1</sup>, otherwise different spark advances will be shown.
- Re 2: Bring engine up to stated engine speed once again and read off spark advance
- Replace control unit

#### Note:

To rule out any confusion between the two 35-pin plugs, in addition to the mechanical locking device the plugs are identified differently. The Motronic plug has a green cable binder.



- 1 = Control unit
- 2 = Locating lug
- 3 = Detent
- 4 = Mounting hole
- 5 = Motronic plug

**E23**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.

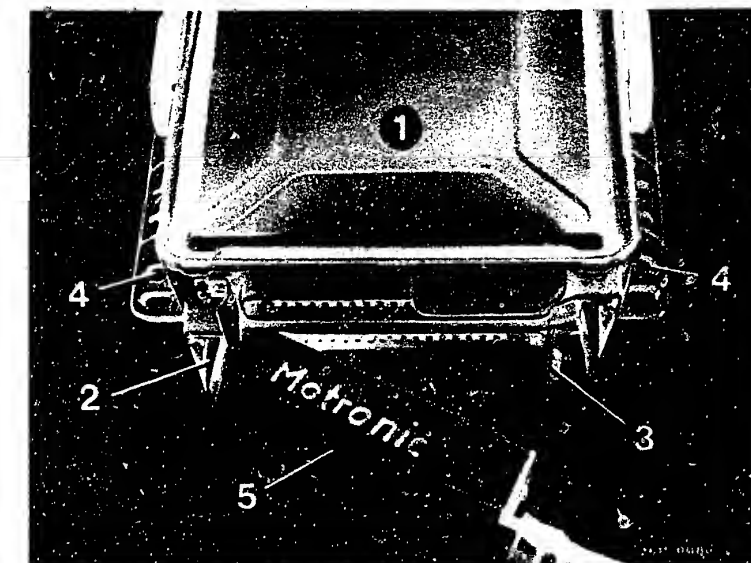


**E24**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



Test step 39			
Operation		Reading	Testing
Program switch position "V"	17	1. With engine at normal operating temperature and at idle speed: <u>8...15°</u>  2. At 2400 min <sup>-1</sup> <u>22...42°</u>   If reading O.K., continue testing with next test step	Component: Control unit
Program switch position "Ω"	15		
Measuring equipment: Motortester			Operation: Dwell angle
Measuring range: Dwell angle			
Connection: Ignition coil			Malfunction: Dwell angle outside tolerance
Operation in vehicle: Let engine run			



- 1 = Control unit
- 2 = Locating lug
- 3 = Detent
- 4 = Mounting hole
- 5 = Motronic plug

#### Trouble-shooting:

Replace control unit

#### Note:

To rule out any confusion between the two 35-pin plugs, in addition to the mechanical locking device the plugs are identified differently. The Motronic plug has a green cable binder.

**F1**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



**F2**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



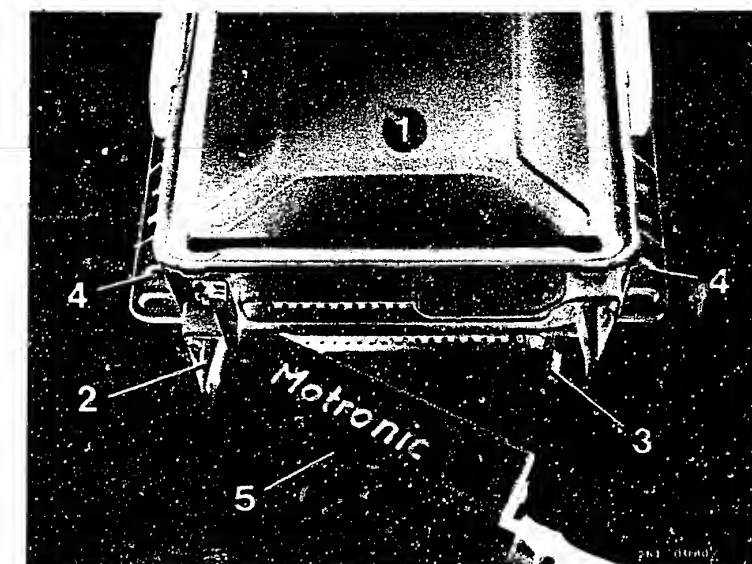
Test step 40			
Operation		Reading	Testing
Program switch position "V"	17	Engine at normal operating temperature Engine speed 2000 min <sup>-1</sup> (keep accelerator in same position). Press button T5:  <u>Engine "hunts"</u>  i.e. Engine speed drops to approx. 1200 min <sup>-1</sup> . Then engine speed rises again to approx. 2000 min <sup>-1</sup> and then drops again, and so on.	<u>Component:</u>  Control unit
Program switch position "Ω"	15		
<u>Measuring equipment:</u> Motortester			<u>Operation:</u>  Cutting off of injection pulses (overrun cutoff)
<u>Measuring range:</u> Engine speed			<u>Malfunction:</u>  No cutoff
<u>Connection:</u> Ignition coil			
<u>Operation in vehicle:</u> Let engine run			
<u>Button:</u> Press T5			

#### Trouble-shooting:

Replace control unit

#### Note:

To rule out any confusion between the two 35-pin plugs, in addition to the mechanical locking device the plugs are identified differently. The Motronic plug has a green cable binder.



- 1 = Control unit
- 2 = Locating lug
- 3 = Detent
- 4 = Mounting hole
- 5 = Motronic plug

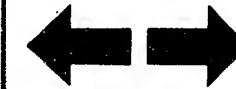
**F3**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.




**F4**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.

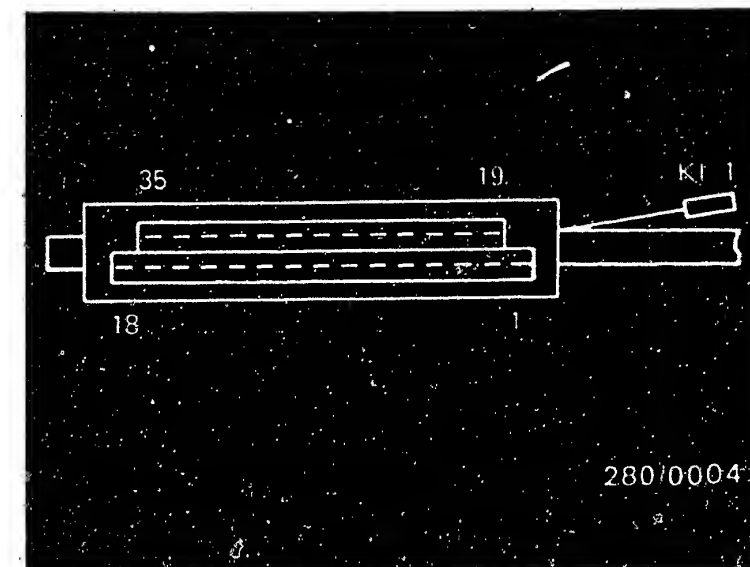


**TEST STEP 41** Caution! By way of exception, voltage is measured at the  $\Omega$  sockets.  
Changeover measuring instrument before switching on ignition.

<u>Operation</u>		<u>Reading</u>	<u>Testing</u>
<u>Program switch "V"</u> <u>at position:</u>		Reading with engine idling <u>approx. 4.5 V</u>	<u>Component:</u> Knock control unit (745i)
<u>Program switch "Ω"</u> <u>at position:</u>	10	After briefly depressing the accelerator as far as the full-load stop, reading moves briefly <u>below 4.5 V</u> and rises again to original value.	
<u>Measuring equipment:</u> Voltmeter			
<u>Measuring range:</u> 15 V			
<u>Connection:</u> Test sockets	Ω		
<u>Operation in vehicle:</u> Let engine idle. Briefly depress accelerator as far as full-load stop (burst of acceleration).			<u>Malfunction:</u> Voltage does not drop.

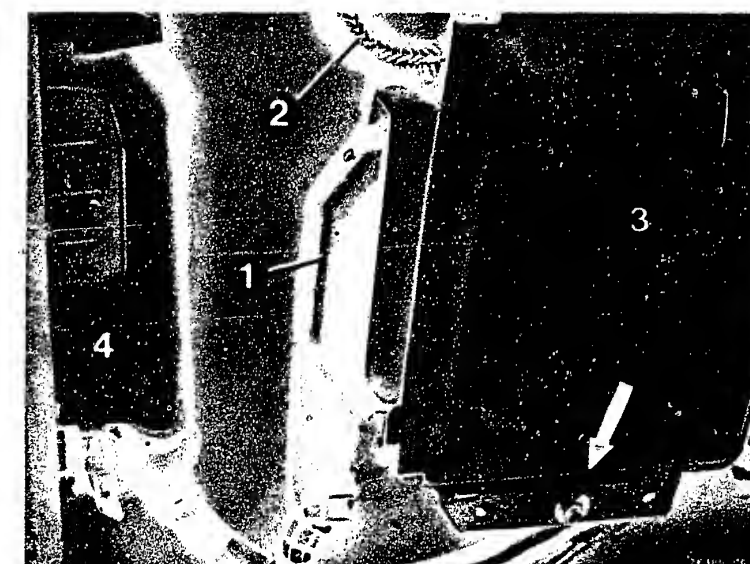
#### Trouble-shooting

- Repeat test.
- Check lead from control unit plug term. 3 to knock-control unit term. 13, including plug connections.
- Knock-control testing is described on a special microcard.



To view of 35-pin control unit plug (black) from Motronic wiring harness term. 1 = plug connection to tachometer

- 1 = Plug for knock control unit
- 2 = Vacuum hose
- 3 = Knock control unit
- 4 = ABS controller
- Arrow = Fastening screw



**F5**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



**F6**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



Testing with the Universal test adapter is now completed.  
If the fault has not been found or if you require  
further information and instructions on how to remedy  
the fault, continue with the trouble-shooting program  
of your choice.

Detailed trouble-shooting → see B3-B4

Direct trouble-shooting → see B5-B10

**F7**

Testing with universal test adapter  
BMW 6 and 7 series with elec. trans.



## 10. Trouble-shooting program according to customer complaints

### How to use the following trouble-shooting program

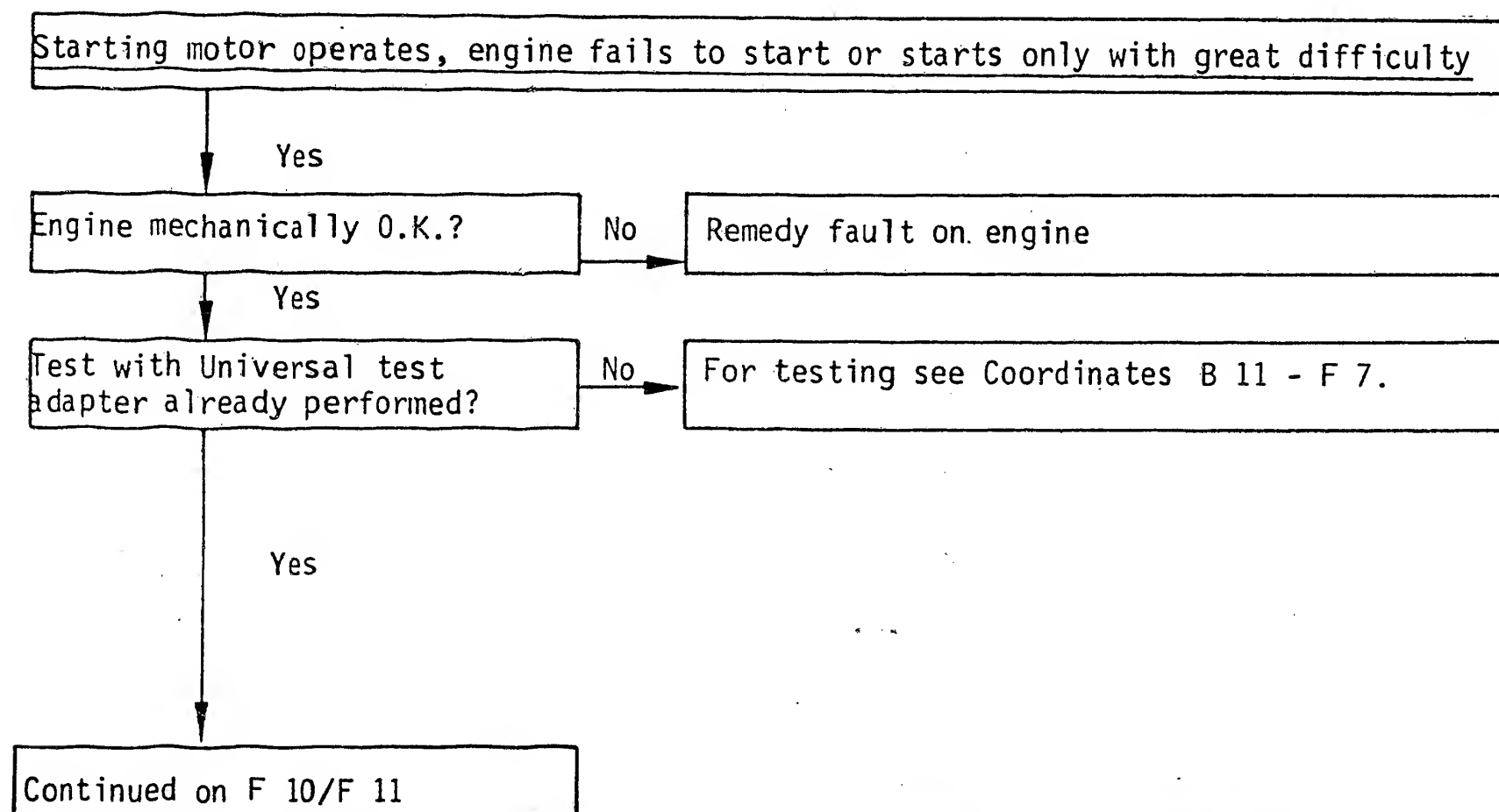
The program is divided into 3 rows of boxes:

1. The left-hand row contains the questions on the tests.
2. The middle row contains descriptions of the testing and adjustment operations on the components.
3. The right-hand row contains the illustrations belonging to the text and explains the illustrations.

If the questions can be answered conclusively with "yes" without testing, proceed to the next question below.

If, on the other hand, the answer to the question is "no", and you suspect a fault, branch to the middle row of boxes and carry out the tests given there.

When you have finished testing continue trouble-shooting at the point at which you branched off.



**F8**

Engine fails to start  
BMW 6 and 7 series with elec. trans.



**F9**

Engine fails to start  
BMW 6 and 7 series with elec. trans.





Starting motor operates, engine fails to start or starts only with great difficulty  
(continued)

Yes

Check secondary pattern of all cylinders at cranking speed. Secondary pattern O.K.?

No

Check ignition coil and high-voltage section:  
Distributor cap oil-fouled inside and outside?  
(Remove distributor rotor and check camshaft seal).  
Note:

Distributor cap fastened with 3 screws. To remove the distributor cap, remove the radiator cover.

When connecting the H.T. ignition cables note the cylinder numbers. Do not forget the hood and screening cover. Check the primary side of the ignition coil for continuity (approx.  $0\Omega$ ).  
Secondary resistance: 5 to 7.2 k $\Omega$ . Check interference-suppression resistors, H.T. ignition cables and spark plugs.

Interference-suppression resistor in

Distributor rotor:	1 k $\Omega$
Distributor domes:	1 k $\Omega$ each
Spark-plug connector:	5 k $\Omega$ each
Spark plugs:	0 k $\Omega$
Ignition coil:	1 k $\Omega$

Yes

While cranking, feel all injection valves by hand. Can needle movement be felt on all valves?

No

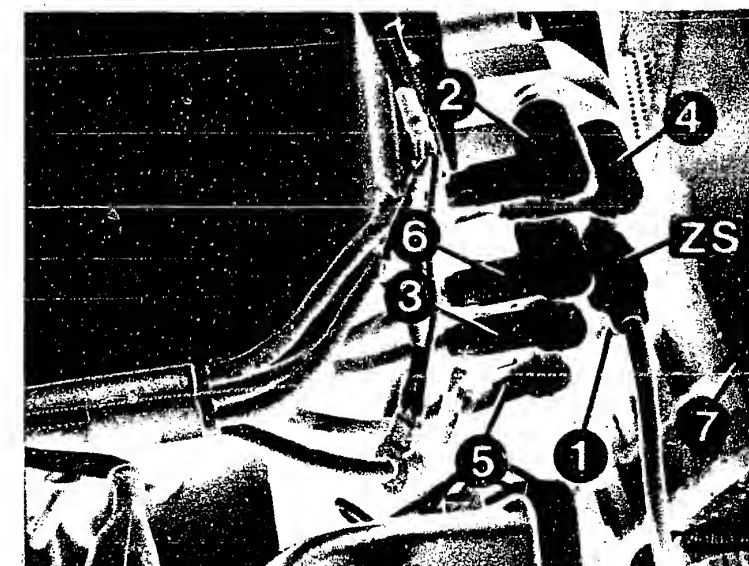
Test injection valve with ohmmeter.  
Test specification: 2 to 3  $\Omega$   
Replace injection valve if defective.

Yes

Yes

Continued on F14/F15

Continued on F12/F13



High-voltage distributor

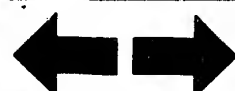
1 to 6 = cylinder numbers  
ZS = High-tension lead to ignition coil  
7 = Radiator cover

1 = Distributor rotor  
Arrows = Fastening screws



**F10**

Engine fails to start  
BMW 6 and 7 series with elec. trans.



**F11**

Engine fails to start  
BMW 6 and 7 series with elec. trans.



Starting motor operates, engine fails to start or starts only with great difficulty  
(continued)

### Removing the solenoid-operated injection valves

Loosen the fastening screws on the fuel-distribution pipe. Pull the fuel-distribution pipe upward until the injection valves are out of the bore in the intake manifold. Do not damage the nozzle needle or rubber seal.

Check the nozzle needle and surrounding area for leaks and deposits.

Remove the electrical connector.

Carefully slide the holding clamps out of the groove and pull the injection valve out of the fuel distribution pipe connection.

### Installing the solenoid-operated injection valves

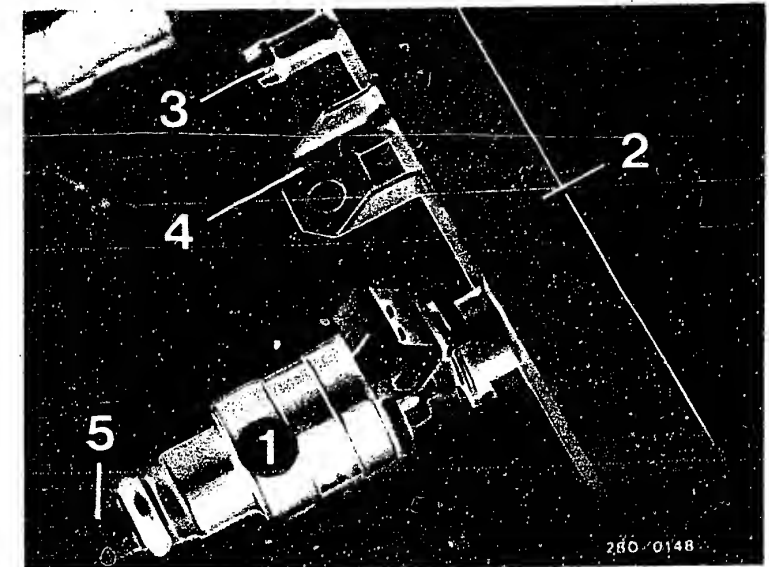
Replace the seals. Press on a new protection sleeve (contained in repair kit) so that the nozzle needle is not damaged.

Check that both rubber seals are correctly seated. Press all 4 injection valves simultaneously into their seats with the fuel-distribution pipe. Secure the fuel-distribution pipe. Check all air and fuel hoses for security. Make the electrical connections.

Start the engine and check whether any unmetered air is being drawn in.

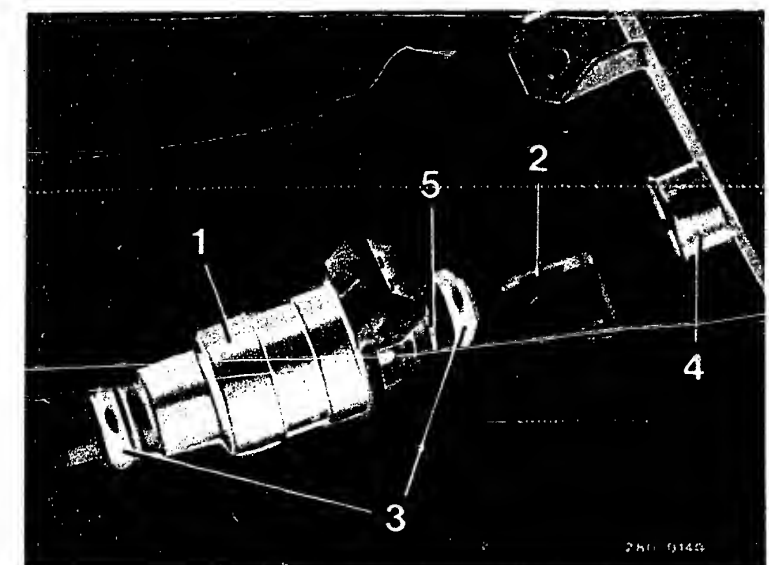
yes

Continued on F14/F15



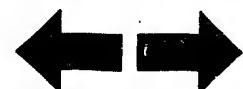
- 1 = Solenoid-operated injection valve
- 2 = Fuel-distribution pipe
- 3 = Connection to start valve
- 4 = Mounting bracket
- 5 = Protection sleeve

- 1 = Solenoid-operated injection valve
- 2 = Holding clamp
- 3 = Rubber seal
- 4 = Fuel-distribution pipe connection
- 5 = Groove



**F12**

Engine fails to start  
BMW 6 and 7 series with elec. trans.



**F13**

Engine fails to start  
BMW 6 and 7 series with elec. trans.



Starting motor operates, engine fails to start or starts only with great difficulty  
(continued)

Yes

Auxiliary-air device tested?

No

Yes

Continued on F16/F17

Testing (mechanical):

### 1. Visual examination of auxiliary-air device:

Remove hoses and look down, using a small mirror. When cold, the device must be open; when the engine is warm, it must be closed. If not, replace auxiliary-air device.

### 2. Functional test of auxiliary-air device:

With the engine cold, pinch off hose to auxiliary-air device. Engine speed must drop. With the engine warm, pinch off hose to auxiliary-air device. Engine speed must not drop. If incorrect, replace auxiliary-air device (pay attention to direction of flow).

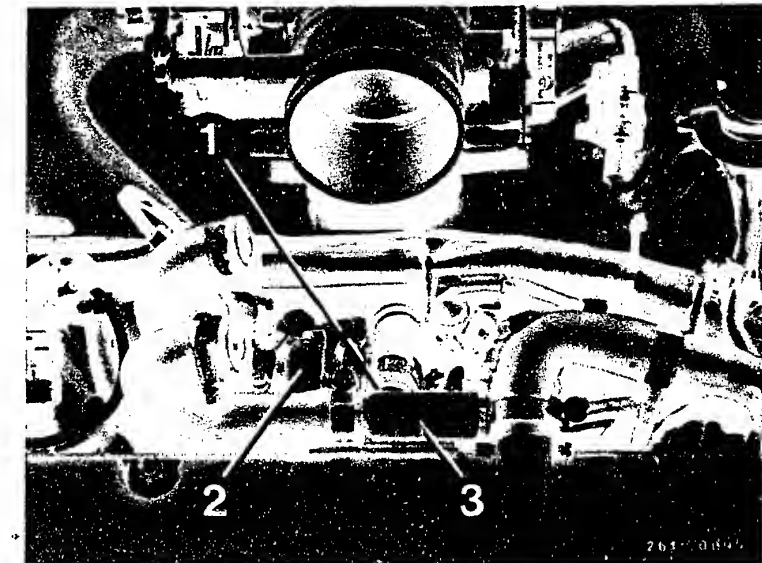
### 3. Electrical test

Remove plug from auxiliary-air device. Connect ohmmeter to both terminals of the auxiliary-air device.

Test values:

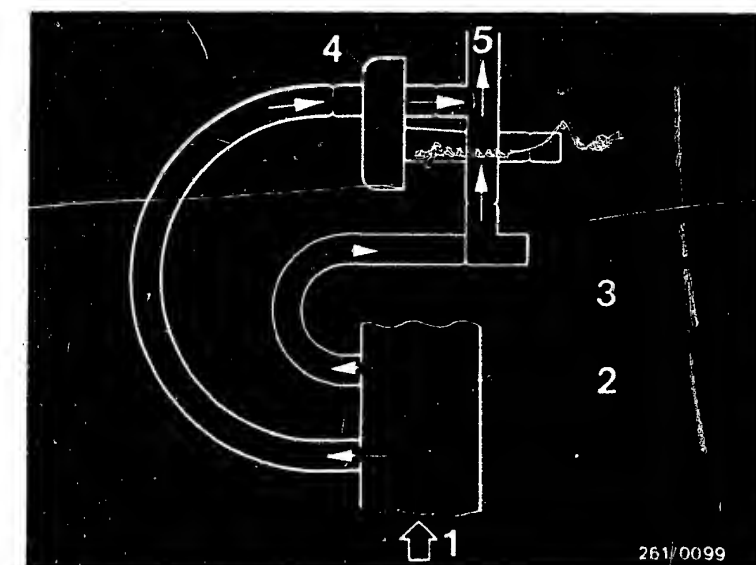
30...65  $\Omega$

If a value outside the tolerance is shown, replace the auxiliary-air device.



- 1 = Start valve
- 2 = Auxiliary-air device
- 3 = Idle-speed-adjusting screw

- 1 = From charge-air cooler
- 2 = Pipe-piece
- 3 = Idle-speed-adjusting screw
- 4 = Auxiliary-air device
- 5 = Bypass air to intake manifold



**F14**

Engine fails to start

BMW 6 and 7 series with elec. trans.



**F15**

Engine fails to start

BMW 6 and 7 series with elec. trans.



Starting motor operates, engine fails to start or starts only with great difficulty  
(continued)

Yes

Start valve O.K.?

No

Functional test: Test power supply to start valve when starting. To do this, remove plug from start valve and connect voltmeter to term. 73 and term. 75/term. 76 of start valve plug.

Coolant at ambient temperature (approx. + 15°... 30°C):

Voltage reading min. 6 V

Coolant with engine at normal operating temperature (approx. + 80°C):

Voltage reading approx. 0 V

Test the following leads for continuity with ohmmeter (set value approx. 0 Ω)

Lead from start valve term. 73 to thermo-time switch term. W:

Lead from start valve term. 75/76 to thermo-time switch term. G.

Lead from start valve term. 75/76 to starter term. 86.

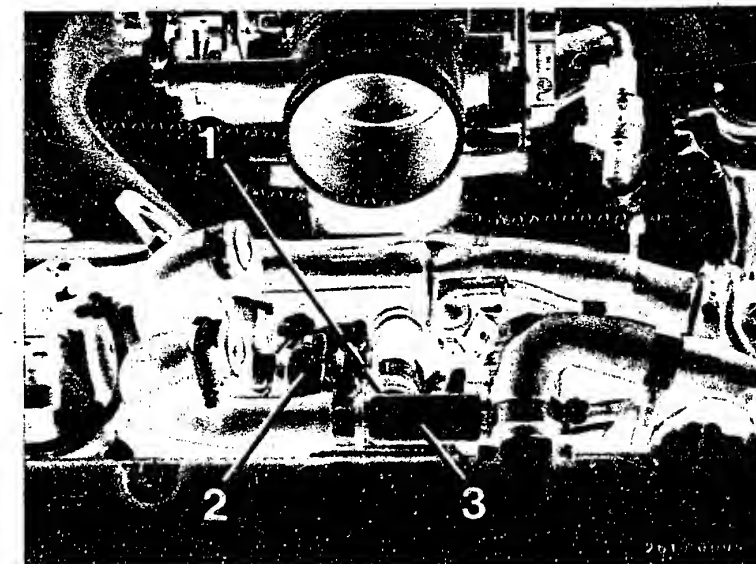
Check ground connection of thermo-time switch.

Yes

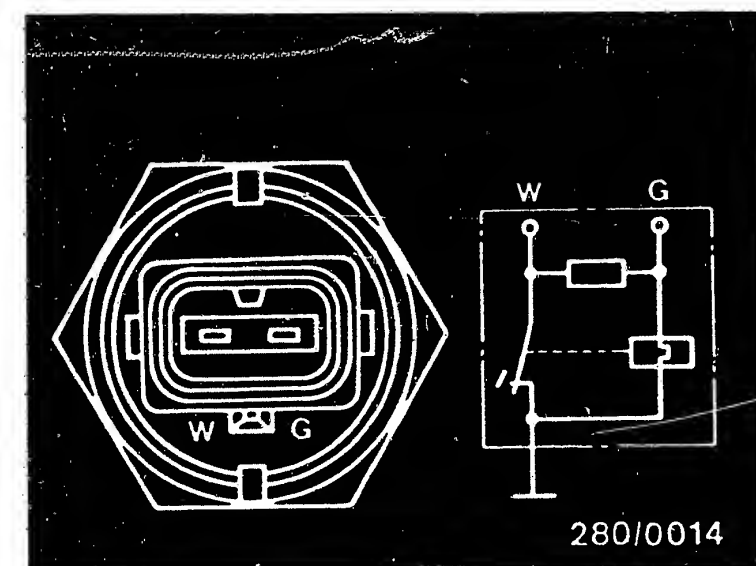
Continued on F22/F23

Continued on F18/F19

Yes



- 1 = Start valve
- 2 = Auxiliary-air device
- 3 = Idle-speed-adjusting screw

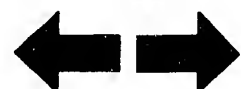


280/0014

**F16**

Engine fails to start

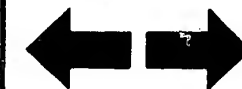
BMW 6 and 7 series with elec. trans.



**F17**

Engine fails to start

BMW 6 and 7 series with elec. trans.



Starting motor operates, engine fails to start or starts only with great difficulty  
(Continued)

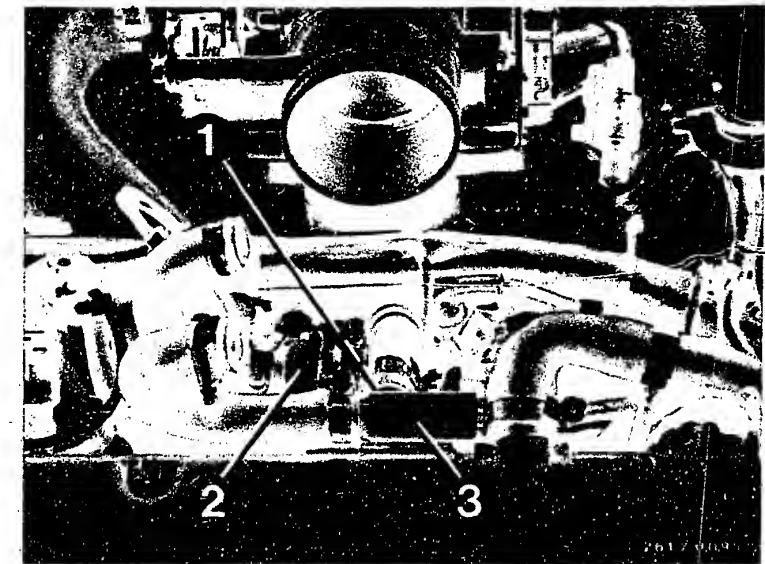
Electric test of start valve:  
Connect ohmmeter to start valve (remove plug):  
Set value approx.  $4 \Omega$ .  
Mechanical test of start valve:  
Remove start valve from intake manifold and hold in a container. (Caution! Fire hazard!).  
When starting at temperatures below ambient temperature (approx.  $+15^{\circ}\dots 30^{\circ}\text{C}$ ) the start valve must squirt (max. 8 sec.). With the engine at normal operating temperature (approx.  $+80^{\circ}\text{C}$ ) the start valve must not squirt. With the ignition switched on and the pressure built up the start valve must likewise not squirt.

Yes

Continued on F22/F23

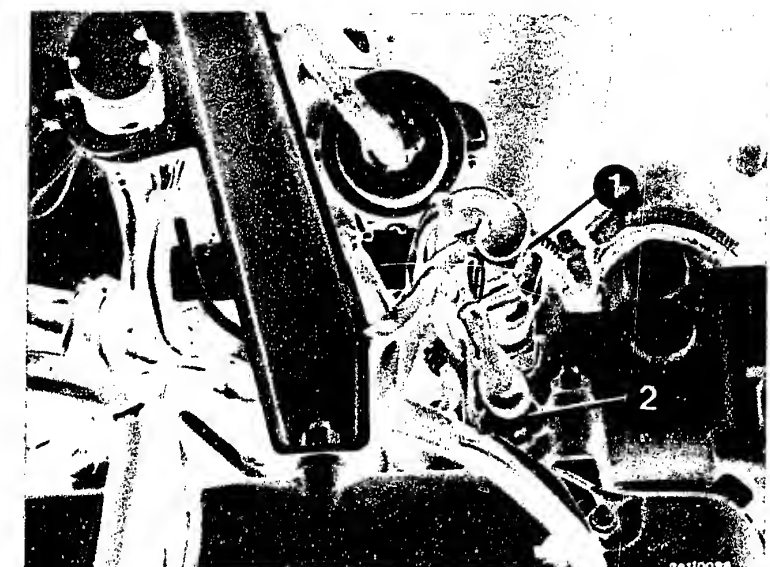
Yes

Continued on F20/F21



- 1 = Start valve
- 2 = Auxiliary-air device
- 3 = Idle-speed-adjusting screw

- 1 = Thermo-time switch
- 2 = Engine temperature sensor (NTC II)



**F18**

Engine fails to start  
BMW 6 and 7 series with elec. trans.



**F19**

Engine fails to start  
BMW 6 and 7 series with elec. trans.





Starting motor operates, engine fails to start or starts only with great difficulty  
(Continued)

Carry out squirt test for engine at normal operating temperature (approx. + 80°C) as follows:  
Remove plug from thermo-time switch and ground term. W.

Testing the start valve for leaks:

1. When installed

Pinch off the fuel delivery line to the start valve. If engine then runs smoothly, replace start valve.

2. When removed

Remove start valve (Caution! Fire hazard!)

Fuel line and electric lead remain connected (place collector vessel under the start valve).

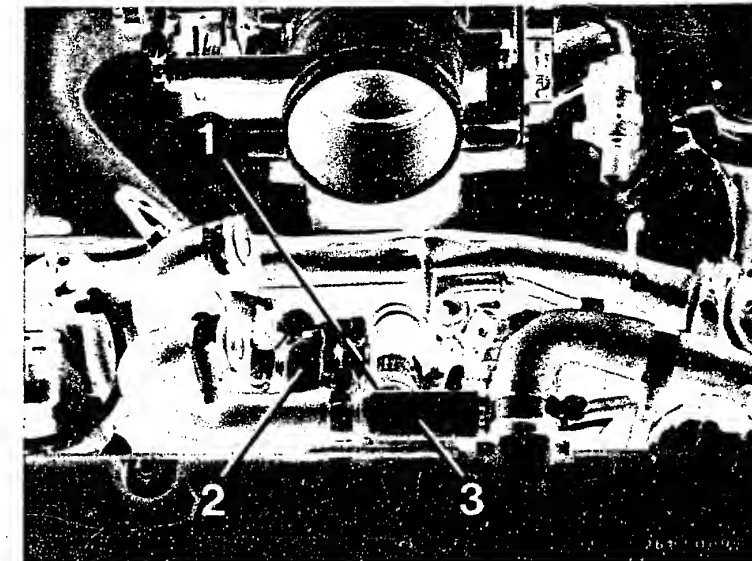
Build up fuel pressure:

On the universal test adapter set the program switch "V" to position 17. Switch on the ignition and press button T 3.

Test specification: Within one minute max. 1 drop may form at the mouth of the valve.

Yes

Continued on F 22/F 23



- 1 = Start valve
- 2 = Auxiliary-air device
- 3 = Idle-speed-adjusting screw

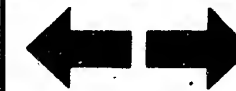
**F20**

Engine fails to start  
BMW 6 and 7 series with elec. trans.



**F21**

Engine fails to start  
BMW 6 and 7 series with elec. trans.



Starting motor operates, engine fails to start or starts only with great difficulty  
(continued)

Thermo-time switch O.K.?

No

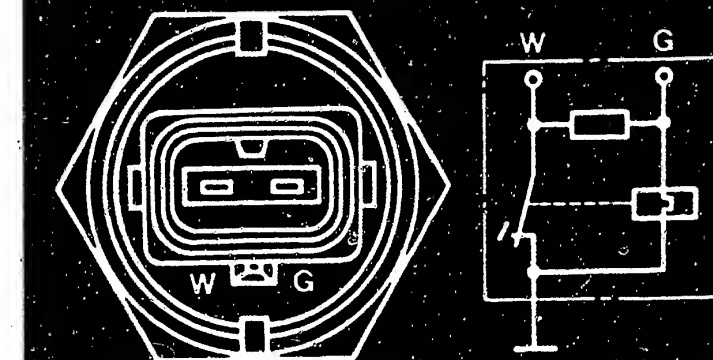
### Electrical test

Test thermo-time switch 35°/8 sec. as follows:  
Remove plug and make direct resistance measurement  
at thermo-time switch using ohmmeter.

	Between term. "G" + ground	Between term. "W" + ground	Between term. "G" + "W"
Ambient temperature (below 30°C)	25...40 Ω	0 Ω	25...40 Ω
Engine at normal operating temperature (above 40°C)	50...80 Ω	100...160 Ω	50...80 Ω

Yes

Continued on G1/G2



280/0014

Thermo-time switch

- 1 = Thermo-time switch
- 2 = Engine temperature sensor (NTC II)



**F22**

Engine fails to start  
BMW 6 and 7 series with elec. trans.



**F23**

Engine fails to start  
BMW 6 and 7 series with elec. trans.





Starting motor operates, engine fails to start or starts only with great difficulty  
(continued)

Yes

Air-flow sensor mechanically  
O.K.?

No

Testing: Open air-flow sensor flap by hand. It must be possible to open the air-flow sensor flap with uniform ease from its fully closed position to its fully open position. When released, the flap must close completely by itself. When the air-flow sensor flap is opened it must not catch at any point. Watch for any indications of abrasion or rubbing. Clean air-flow sensor if the inside is very dirty and rub out with a lint-free cloth. If there are any signs of abrasion or rubbing, replace the air-flow sensor.

Yes

Are all hose lines and electric  
leads securely attached?  
Visual examination.  
Is the air-intake system leak-  
tight?

No

Check whether hoses of air-intake system and of fuel line system are securely attached, not kinked or damaged. If necessary, replace hoses. Eliminate leaks with new seals or by re-tightening the connecting screws.

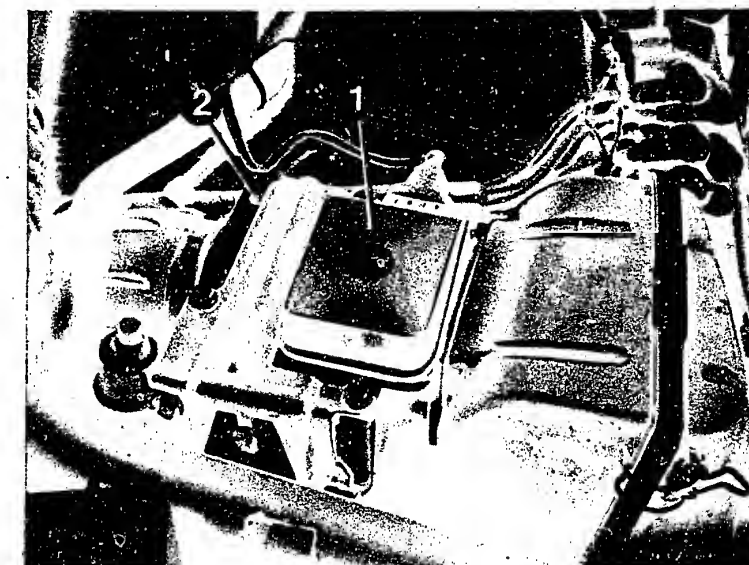
Checking for leaks: Seal off exhaust tail pipe. Remove air-filter element and seal off air-flow sensor duct.

Unscrew hose to auxiliary-air device at pipe section and blow air (approx. 0.3 bar gauge pressure) into the pipe section with compressed-air gun. Seal off auxiliary-air device connection. Open throttle valve all the way. Brush or spray on leak-detector spray or soapy water at all sealing joints. Bubbles or foam indicate leakage.

Check electrical contacts for loose contacts.

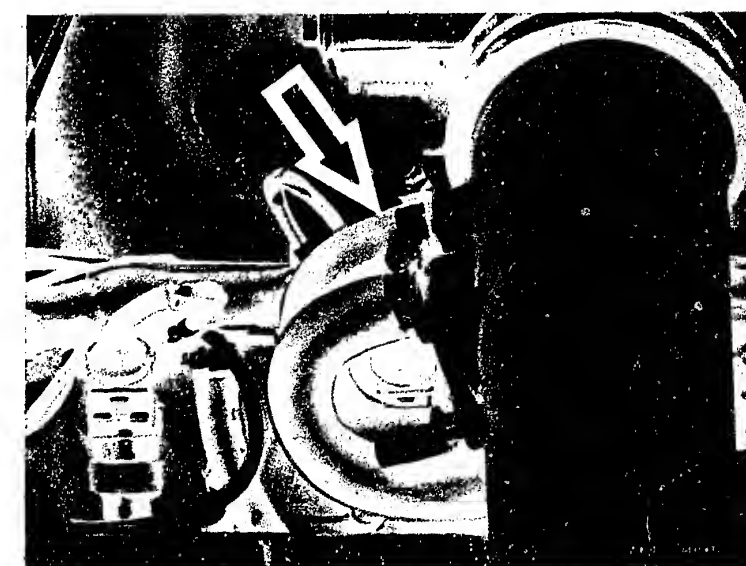
Yes

Continued on G3/G4



1 = Air-flow sensor with NTC I  
2 = Idle-mixture-adjusting screw

Arrow = Hose to auxiliary-air device



**G1**

Engine fails to start

BMW 6 and 7 series with elec. trans.



**G2**

Engine fails to start

BMW 6 and 7 series with elec. trans.



Starting motor operates, engine fails to start or starts only with great difficulty  
(continued)

Yes

Testing completed for customer complaint

"Starting motor operates, engine fails to start or starts only with great difficulty",

Customer complaint remedied?

No

Further possibilities

- Customer complaint incorrectly diagnosed (see Coordinates B3...B10). If the fault has not be detected by "direct trouble-shooting", see "detailed trouble-shooting" (Coordinates B3/B4).
- Engine not mechanically O.K. (Compression, valve setting, valve timing, worn camshaft).

**G3**

Engine fails to start

BMW 6 and 7 series with elec. trans.



**G4**

Engine fails to start

BMW 6 and 7 series with elec. trans.



## Trouble-shooting program according to customer complaints

### How to use the following trouble-shooting program

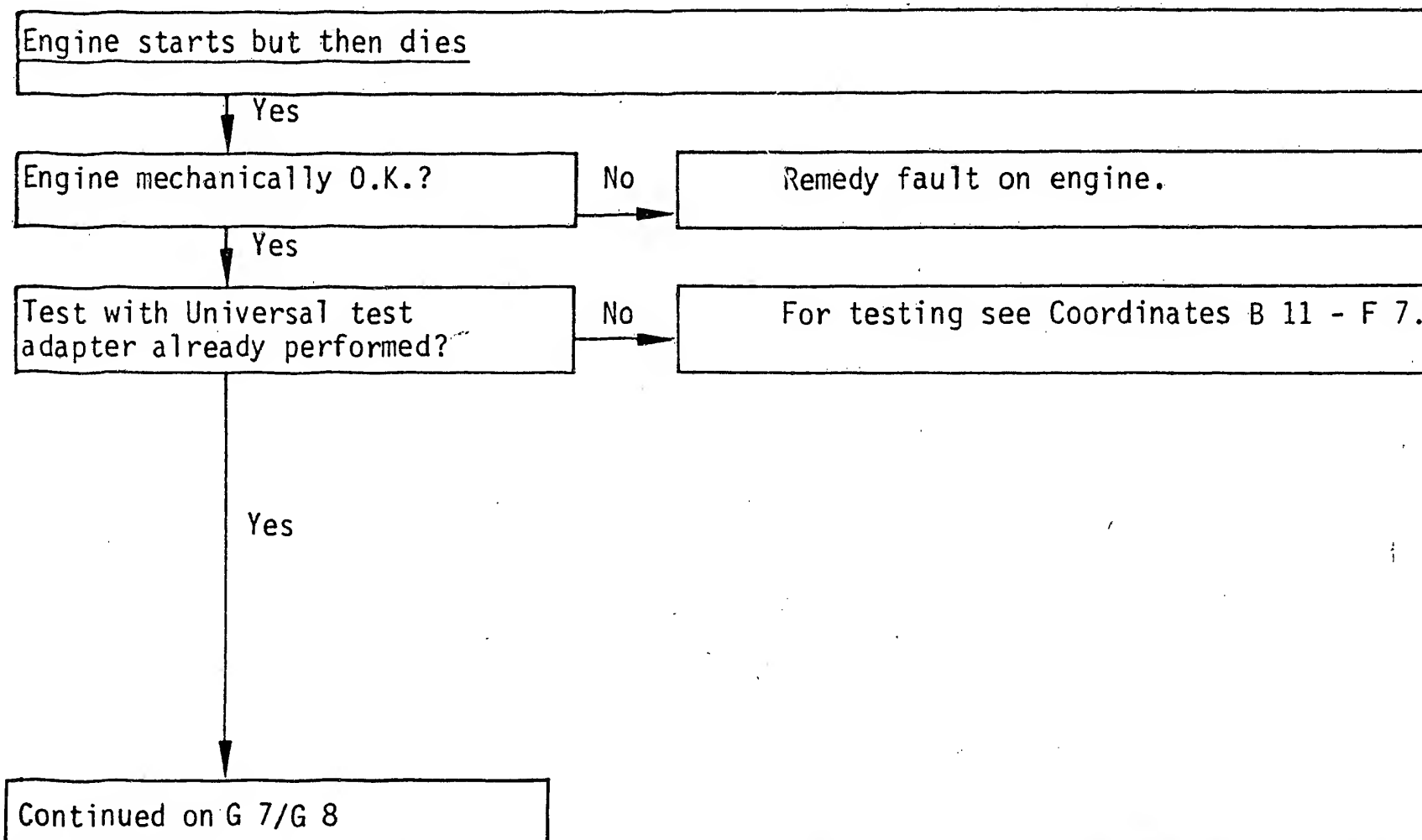
The program is divided into 3 rows of boxes:

1. The left-hand row contains the questions on the tests.
2. The middle row contains descriptions of the testing and adjustment operations on the components.
3. The right-hand row contains the illustrations belonging to the text and explains the illustrations.

If the questions can be answered conclusively with "yes" without testing, proceed to the next question below.

If, on the other hand, the answer to the question is "no", and you suspect a fault, branch to the middle row of boxes and carry out the tests given there.

When you have finished testing continued trouble-shooting at the point at which you branched off.



**G5**

Engine starts but then dies  
BMW 6 and 7 series with elec. trans.



**G6**

Engine starts but then dies  
BMW 6 and 7 series with elec. trans.



Engine starts but then dies (continued)

Yes

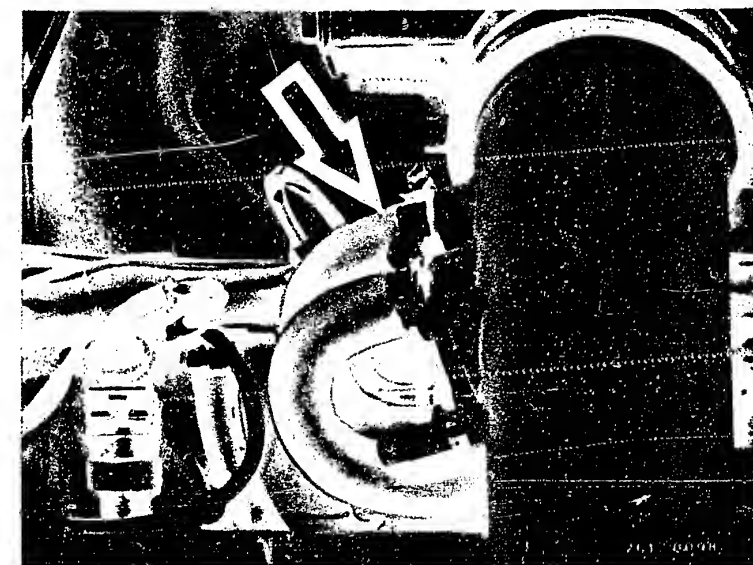
Are all hose lines and electric leads securely attached?  
Visual examination.  
Is the air-intake system leak-tight?

no

Check whether hoses of air-intake system and of fuel line system are securely attached, not kinked or damaged. If necessary, replace hoses. Eliminate leaks with new seals or by re-tightening the connecting screws.  
Checking for leaks: Seal off exhaust tail pipe. Remove air-filter element and seal off air-flow sensor duct. Unscrew hose to auxiliary-air device at pipe section and blow air (approx. 0.3 bar gauge pressure) into the pipe section with compressed-air gun. Seal off auxiliary-air device connection. Open throttle valve all the way. Brush or spray on leak-detector spray or soapy water at all sealing joints. Bubbles or foam indicate leakage. Check electrical contacts for loose contacts.

Yes

Continued on G 9/G 10



Arrow = Hose to auxiliary-air device

**G7**

Engine starts but then dies  
BMW 6 and 7 series with elec. trans.



**G8**

Engine starts but then dies  
BMW 6 and 7 series with elec. trans.



## Engine starts but then dies (continued)

Yes

Auxiliary-air device tested?

No

### Testing (mechanical):

#### 1. Visual examination of auxiliary-air device

Remove hoses and look down, using a small mirror. When cold, the device must be open; when the engine is warm, it must be closed. If not, replace auxiliary-air device.

#### 2. Functional test of auxiliary-air device

When engine is cold, disconnect hose to auxiliary-air device. Engine speed must drop.  
When engine is warm, disconnect hose to auxiliary-air device. Engine speed must not drop.  
If not replace auxiliary-air device (observe direction of flow).

#### 3. Electrical test

Disconnect plug of auxiliary-air device.  
Connect ohmmeter to both terminals of the auxiliary-air device.

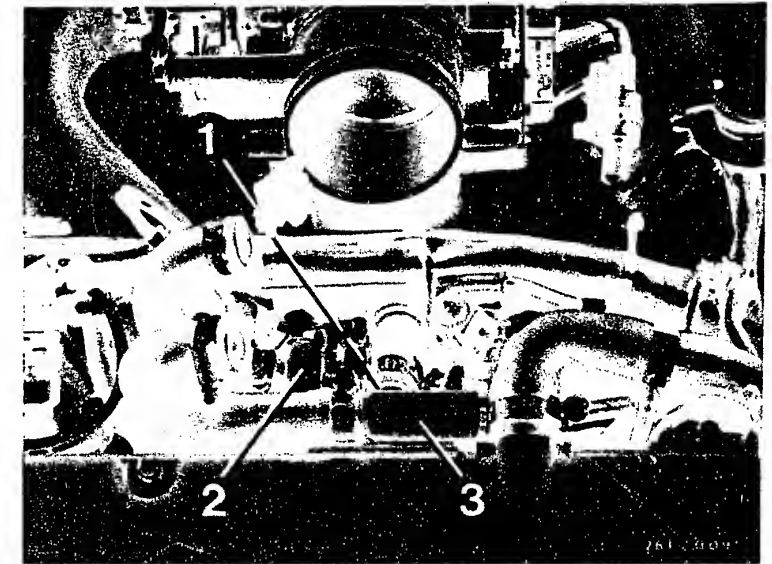
Test value

30...65  $\Omega$

If a value outside tolerance is shown, replace auxiliary-air device.

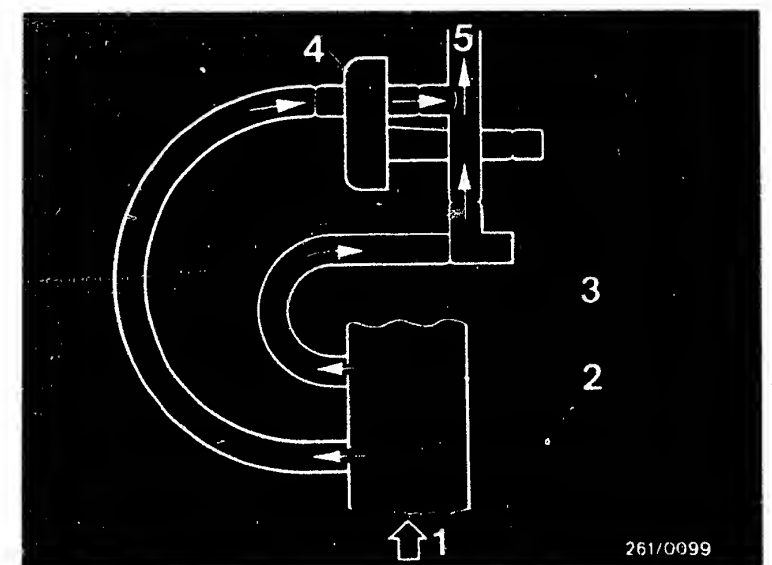
Yes

Continued on G 11/G 12



- 1 = Start valve
- 2 = Auxiliary-air device
- 3 = Idle-speed-adjusting screw

- 1 = From charge-air cooler
- 2 = Pipe piece
- 3 = Idle-speed-adjusting screw
- 4 = Auxiliary-air device
- 5 = Bypass air to intake manifold



261/0099

**G9**

Engine starts but then dies  
BMW 6 and 7 series with elec. trans.



**G10**

Engine starts but then dies  
BMW 6 and 7 series with elec. trans.



## Engine starts but then dies (Continued)

Start valve O.K.?  
(Leak test)

No

### Testing the start valve for leaks:

#### 1. When installed

Pinch off the fuel delivery line to the start valve. If engine then runs smoothly, replace start valve.

#### 2. When removed

Remove start valve (caution - fire hazard). Fuel line and electric lead remain connected (place collector vessel under start valve).

Build up fuel pressure:

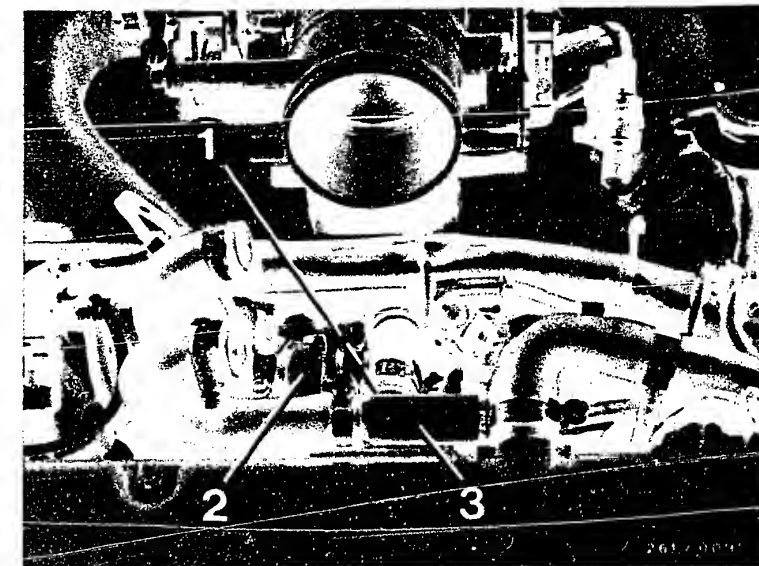
On universal test adapter set program switch "V" to position 17.

Switch on ignition and press button T 3.

Test specification: Within one minute max. 1 drop may form at the mouth of the valve.

Yes

Continued on G 13/G 14

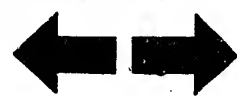


- 1 = Start valve
- 2 = Auxiliary-air device
- 3 = Idle-speed-adjusting screw

**G 11**

Engine starts but then dies

BMW 6 and 7 series with elec. trans.



**G 12**

Engine starts but then dies

BMW 6 and 7 series with elec. trans.



Engine starts but then dies (continued)

Thermo-time switch  
O.K.?

No

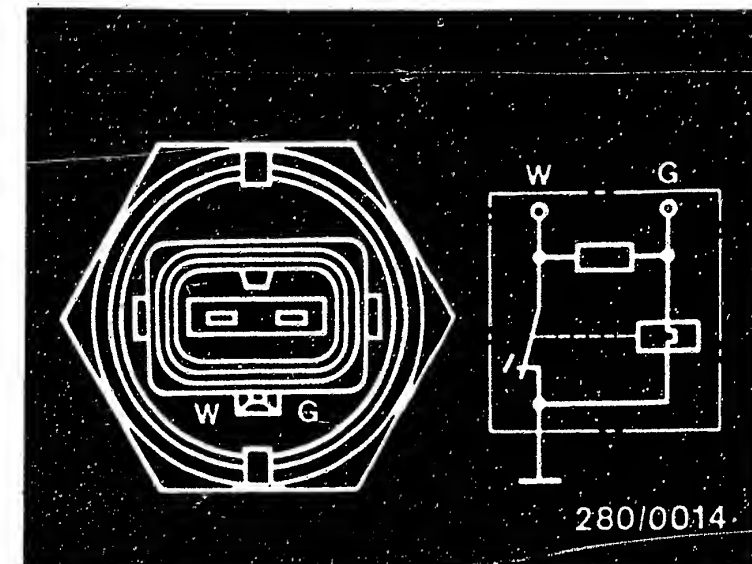
### Electrical test

Test thermo-time switch 35°/8 sec. as follows:  
Remove plug and make direct resistance measurement  
at thermo-time switch using ohmmeter.

	Between term. "G" + ground	Between term. "W" + ground	Between term. "G" + "W"
Ambient temperature (below 30°C)	25...40 Ω	0 Ω	25...40 Ω
Engine at normal operating temperature (above 40°C)	50...80 Ω	100...160 Ω	50...80 Ω

Yes

Continued on G15/G16



Thermo-time switch

- 1 = Thermo-time switch
- 2 = Engine temperature sensor (NTC II)



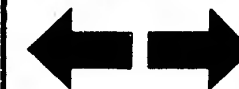
**G13**

Engine starts but then dies  
BMW 6 and 7 series with elec. trans.



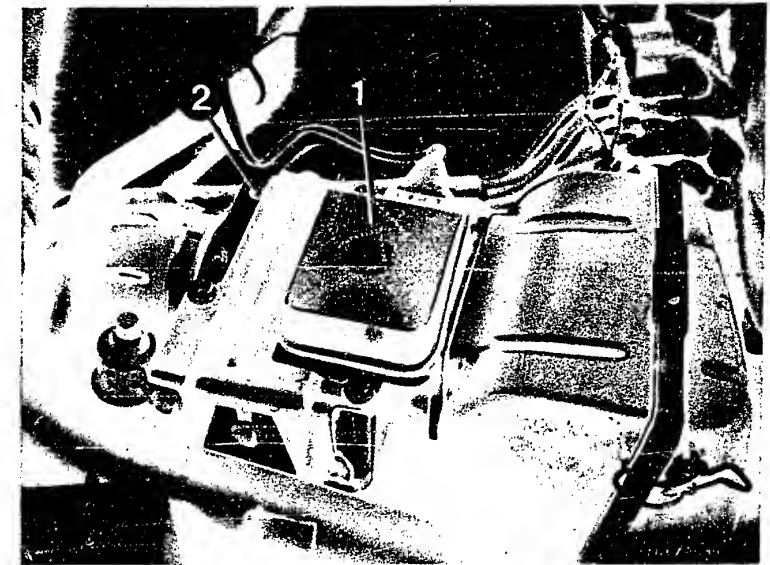
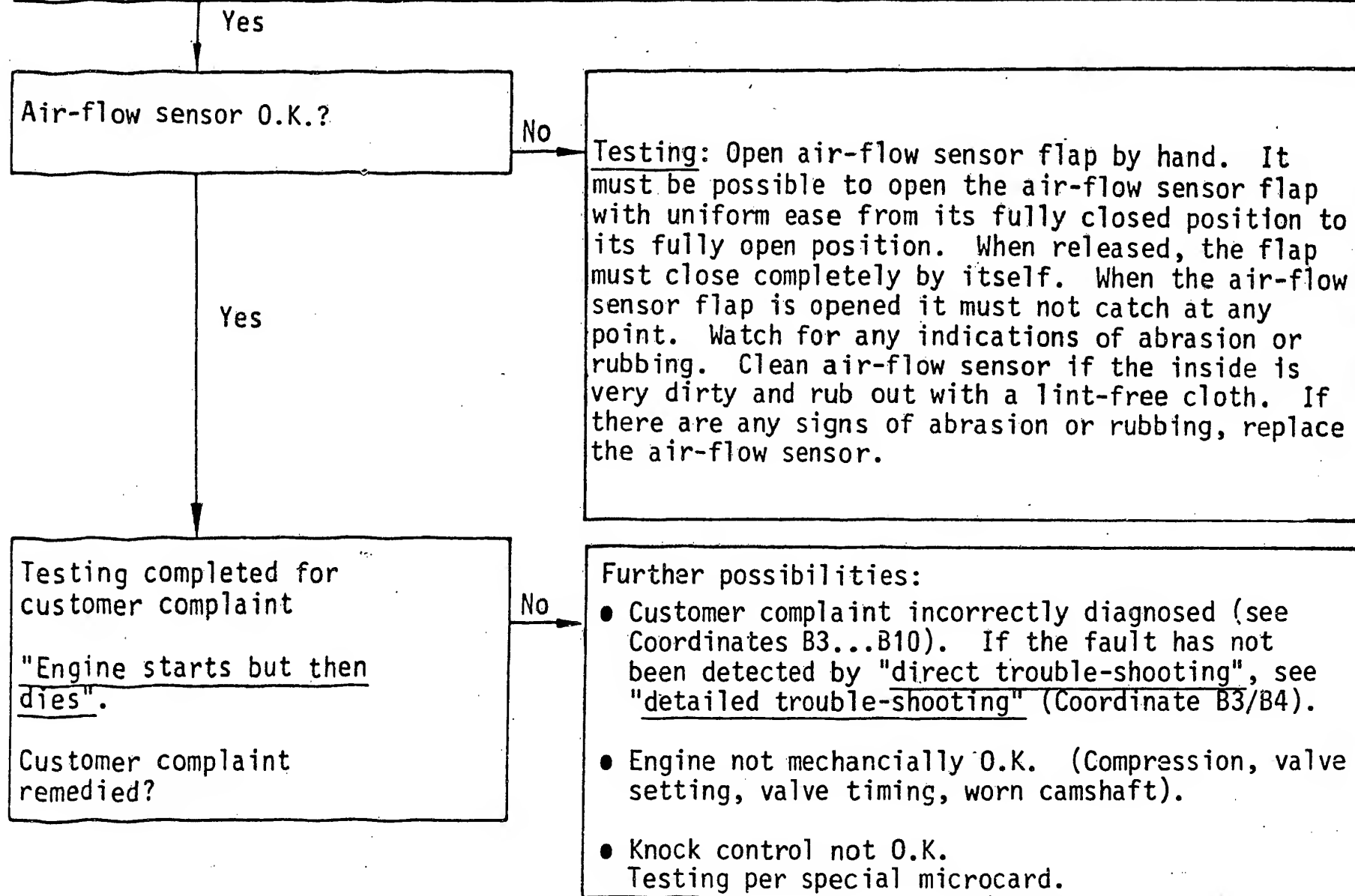
**G14**

Engine starts but then dies  
BMW 6 and 7 series with elec. trans.





Engine starts but then dies (continued)



1 = Air-flow sensor with NTC I  
2 = Idle-mixture-adjusting screw



## Trouble-shooting program according to customer complaints

### How to use the following trouble-shooting program

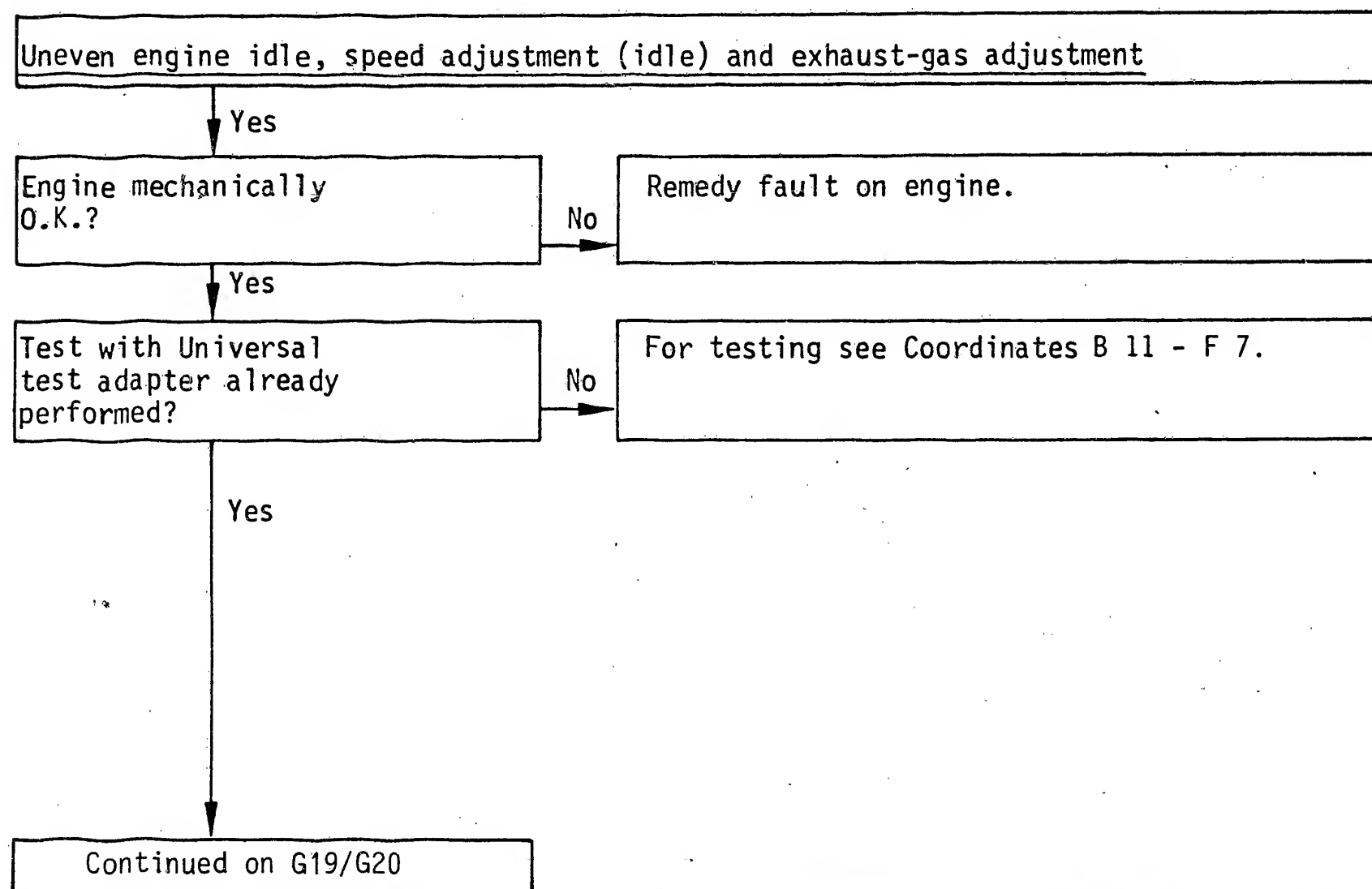
The program is divided into 3 rows of boxes:

1. The left-hand row contains the questions on the tests.
2. The middle row contains descriptions of the testing and adjustment operations on the components.
3. The right-hand row contains the illustrations belonging to the text and explains the illustrations.

If the questions can be answered conclusively with "yes" without testing, proceed to the next question below.

If, on the other hand, the answer to the question is "no", and you suspect a fault, branch to the middle row of boxes and carry out the tests given there.

When you have finished testing continue trouble-shooting at the point at which you branched off.

**G17**

Uneven engine idle

BMW 6 and 7 series with elec. trans.

**G18**

Uneven engine idle

BMW 6 and 7 series with elec. trans.



# Uneven engine idle, speed adjustment (idle) and exhaust-gas adjustment (continued)

Yes

Check secondary pattern of all cylinders.  
Secondary pattern O.K.?

No

## Note:

The distributor cap is fastened with 3 screws. To remove the distributor cap, it is necessary to remove the radiator cover.

When plugging on the H.T. ignition cables, pay attention to the cylinder numbers. Do not forget the cap and screening cover.

Check ignition coil primary for continuity (approx.  $0\ \Omega$ ). Secondary resistance:  $5...7.2\ k\Omega$ . Test interference-suppression resistors, H.T. ignition cables and spark plugs.

Interference-suppression resistor in

Distributor rotor:  $1\ k\Omega$

Distributor domes:  $1\ k\Omega$  each

Spark-plug connector:  $5\ k\Omega$  each

Spark plugs:  $0\ k\Omega$

Ignition coil:  $1\ k\Omega$

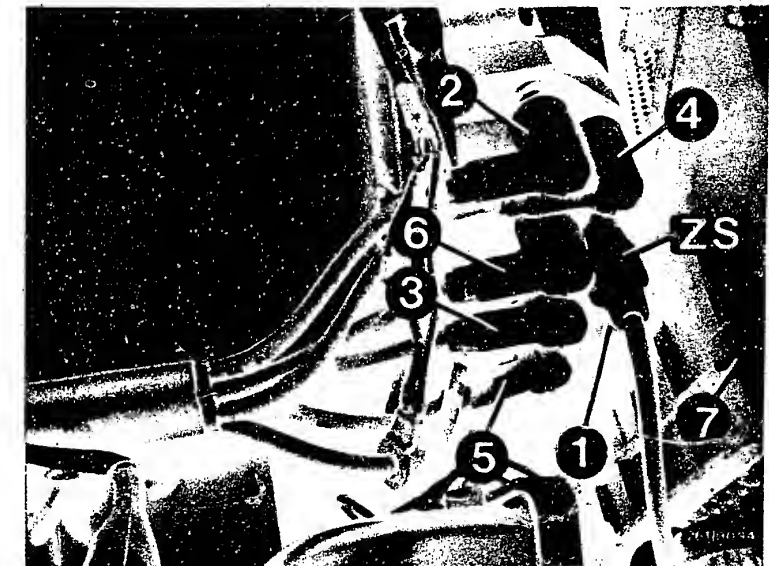
Yes

Air-flow sensor O.K.?

No

Testing: Open air-flow sensor flap by hand. It must be possible to open the air-flow sensor flap with uniform ease from its fully closed position to its fully open position. When released, the flap must close completely by itself. When the air-flow sensor flap is opened it must not catch at any point. Watch for any indications of abrasion or rubbing. Clean air-flow sensor if the inside is very dirty and rub out with a lint-free cloth. If there are any signs of abrasion or rubbing, replace the air-flow sensor.

Continued on G21/G22



## High-voltage distributor

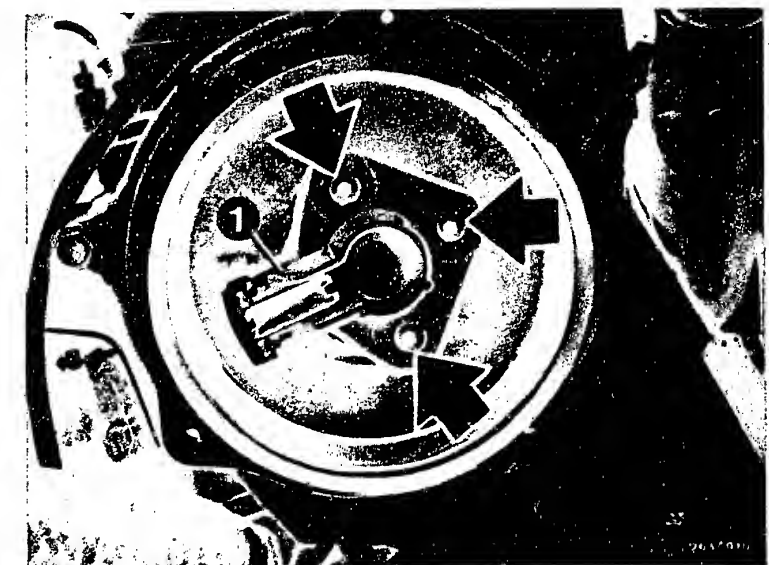
1 to 6 = cylinder numbers

ZS = High-tension lead to ignition coil

7 = Radiator cover

1 = Distributor rotor

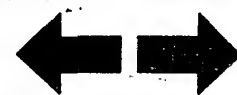
Arrows = Fastening screws



G19

Uneven engine idle

BMW 6 and 7 series with elec. trans.



G20

Uneven engine idle

BMW 6 and 7 series with elec. trans.



Uneven engine idle, speed adjustment (idle) and exhaust-gas adjustment  
(continued)

Throttle valve closed?

No

Testing:

Check whether the throttle valve can be closed still further and whether the engine speed thereby drops.

Visual examination:

Loosen hose clamp and push back charge-air tube.

Throttle valve set to hair's breadth gap? If necessary, adjust at connecting plate.

After correcting, re-adjust throttle cable, micro-switch and potentiometer (part of knock control).

Adjusting the microswitch:

Slightly loosen fastening screws. Connect ohmmeter to microswitch. Turn operating lever to "full throttle" and slowly return to idle stop. Turn microswitch until idle contact (microswitch) can be heard to switch (reading  $0 \Omega$ ). Tighten screws.

Checking the adjustment:

Pull slightly on throttle cable. The idle contact must be heard to switch (reading  $\infty \Omega$ ).

Trouble-shooting:

Test the following leads for continuity using ohmmeter (set value approx.  $0 \Omega$ ):

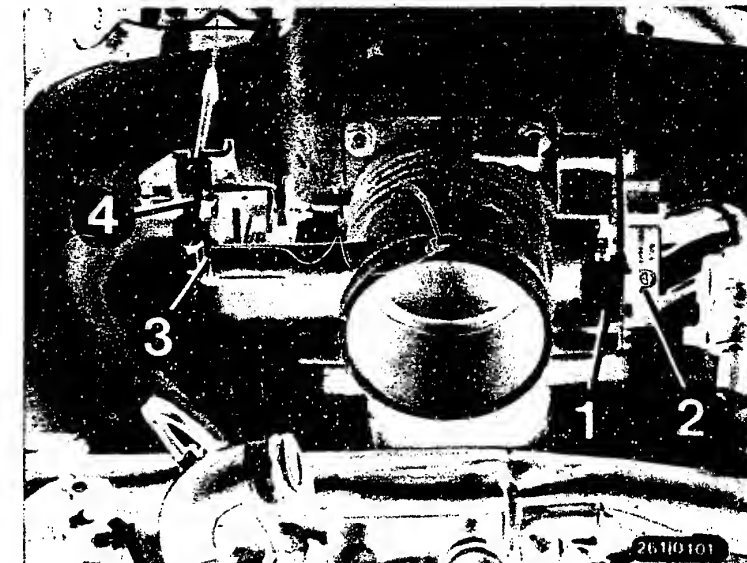
From control unit plug term. 2 to microswitch.

From microswitch to ground terminal.

Eliminate contact resistances in the plug-in connections.

Yes

Continued on G23/G24



- 1 = Microswitch
- 2 = Potentiometer
- 3 = Connecting plate
- 4 = Throttle cable

**G21**

Uneven engine idle

BMW 6 and 7 series with elec. trans.



**G22**

Uneven engine idle

BMW 6 and 7 series with elec. trans.



Uneven engine idle, speed adjustment (idle) and exhaust-gas adjustment (continued)

Yes

Are all hose lines and electric leads securely attached?  
Visual examination.  
Is the air-intake system leak-tight?

no

Check whether hoses of air-intake system and of fuel line system are securely attached, not kinked or damaged. If necessary, replace hoses. Eliminate leaks with new seals or by re-tightening the connecting screws.

Checking for leaks: Seal off exhaust tail pipe. Remove air-filter element and seal off air-flow sensor duct.

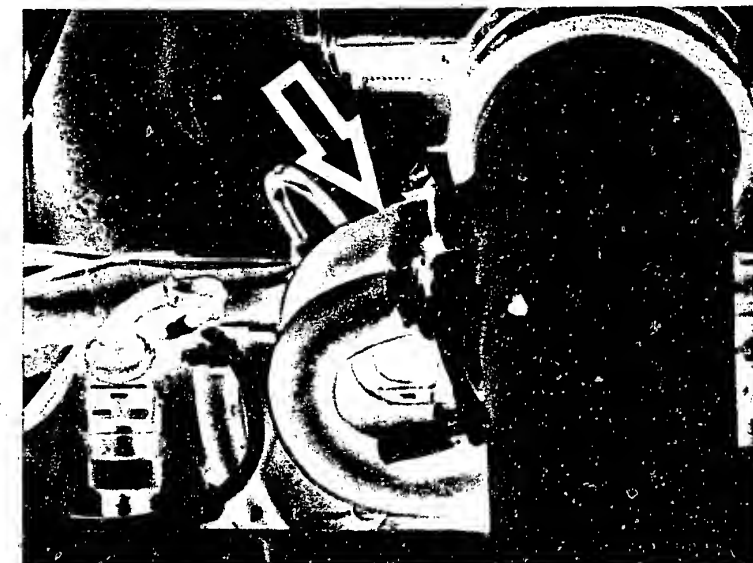
Unscrew hose to auxiliary-air device at pipe section and blow air (approx. 0.3 bar gauge pressure) into the pipe section with compressed-air gun. Seal off auxiliary-air device connection. Open throttle valve all the way. Brush or spray on leak-detector spray or soapy water at all sealing joints.

Bubbles or foam indicate leakage.

Check electrical contacts for loose contacts.

Yes

Continued on H1/H2

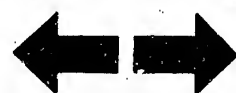


Arrow = Hose to auxiliary-air device

**G23**

Uneven engine idle

BMW 6 and 7 series with elec. trans.



**G24**

Uneven engine idle

BMW 6 and 7 series with elec. trans.



Uneven engine idle, speed adjustment (idle) and exhaust-gas adjustment (continued)

Yes

Auxiliary-air device tested?

No

Yes

Testing (mechanical):

1. Visual examination of auxiliary-air device:  
Remove hoses and look down, using a small mirror. When cold, the device must be open when the engine is warm, it must be closed. If not, replace auxiliary-air device.

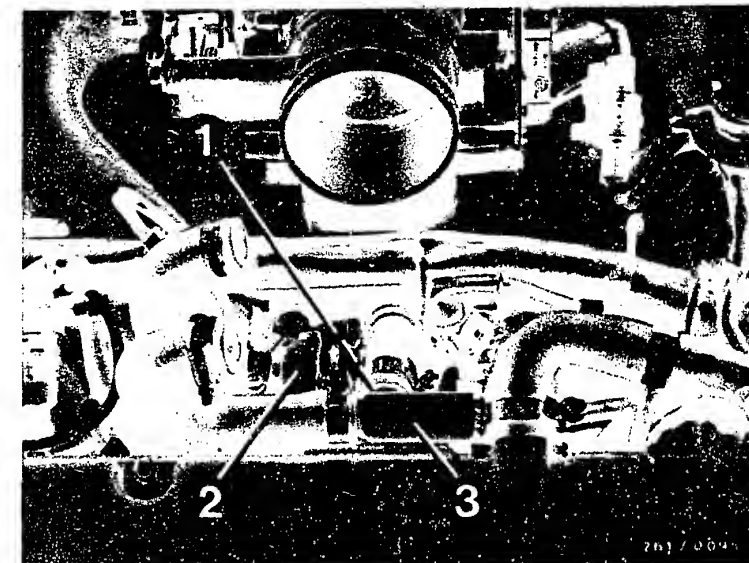
2. Functional test of auxiliary-air device:  
With the engine cold, pinch off hose to auxiliary-air device. Engine speed must drop. With the engine warm, pinch off hose to auxiliary-air device. Engine speed must not drop. If incorrect, replace auxiliary-air device (pay attention to direction of flow).

3. Electrical test:  
Disconnect plug of auxiliary-air device. Connect ohmmeter to both terminals of the auxiliary-air device.

Test value

30...65  $\Omega$

If a value outside the tolerance is shown, replace the auxiliary-air device.



- 1 = Start valve  
2 = Auxiliary-air device  
3 = Idle-speed-adjusting screw

Continued on H3/H4

**H1**

Uneven engine idle  
BMW 6 and 7 series with elec. trans.



**H2**

Uneven engine idle  
BMW 6 and 7 series with elec. trans.





# Uneven engine idle, speed adjustment (idle) and exhaust-gas adjustment (Continued)

Thermo-time switch O.K.?

No

## Electrical test:

Test thermo-time switch 35°/8 sec. as follows. Remove plug and make direct resistance measurement at thermo-time switch using ohmmeter.

1. Between term. "G" and ground at ambient temperature (below +30°C): 25...40 Ω. With engine approximately at normal operating temperature (above +40°C): 50...80 Ω.

2. Between term. "W" and ground at ambient temperature (below +30°C): 0 Ω. With engine approximately at normal operating temperature (above +40°C): 100...160 Ω.

3. Between term. "G" and "W" at ambient temperature (below +30°C): 25...40 Ω. With engine approximately at normal operating temperature (above +40°C): 50...80 Ω.

Yes

Start valve O.K.?

No

## Checking the start valve for leaks:

1. When installed

Pinch off fuel delivery line to start valve. If engine then runs smoothly, replace start valve.

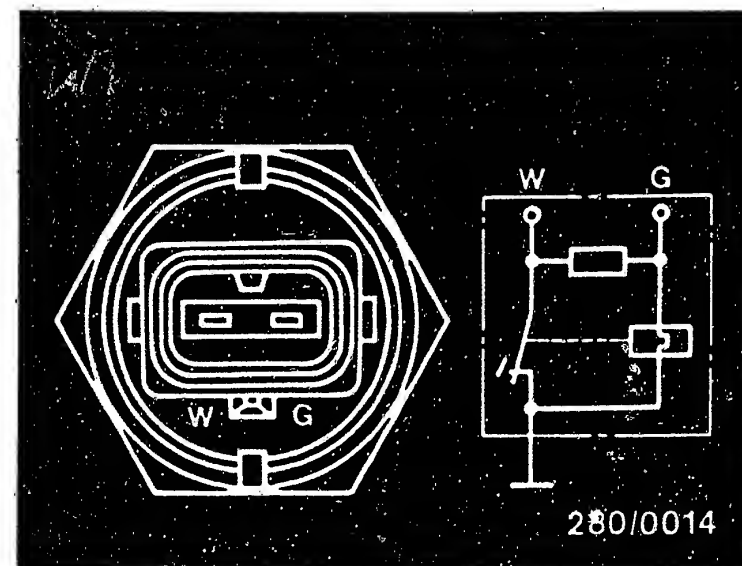
2. When removed

Remove start valve (caution - fire hazard!). Fuel line and electric lead remain connected (place collector vessel under start valve). Build up fuel pressure. On universal test adapter, set program switch "V" to position 17. Switch on ignition and press button T 3.

Yes

Continued on H7/H8

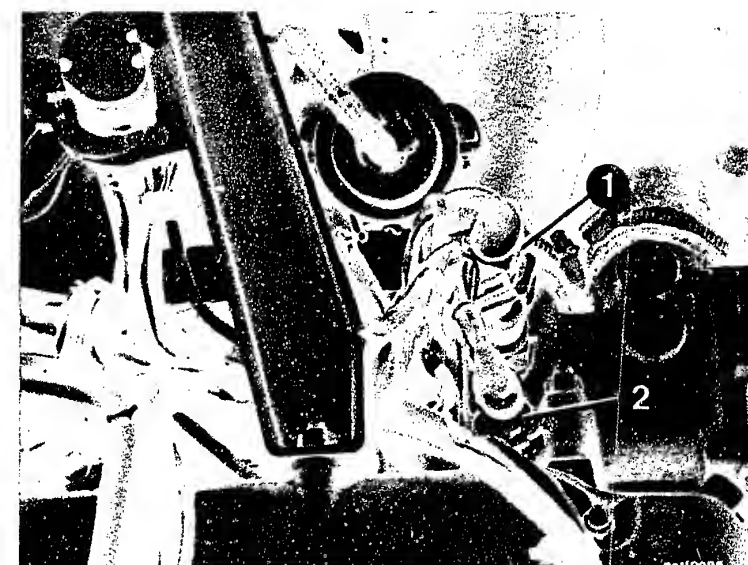
Continued on H5/H6



280/0014

Thermo-time switch

1 = Thermo-time switch  
2 = Engine temperature sensor (NTC II)



H3

Uneven engine idle

BMW 6 and 7 series with elec. trans.



H4

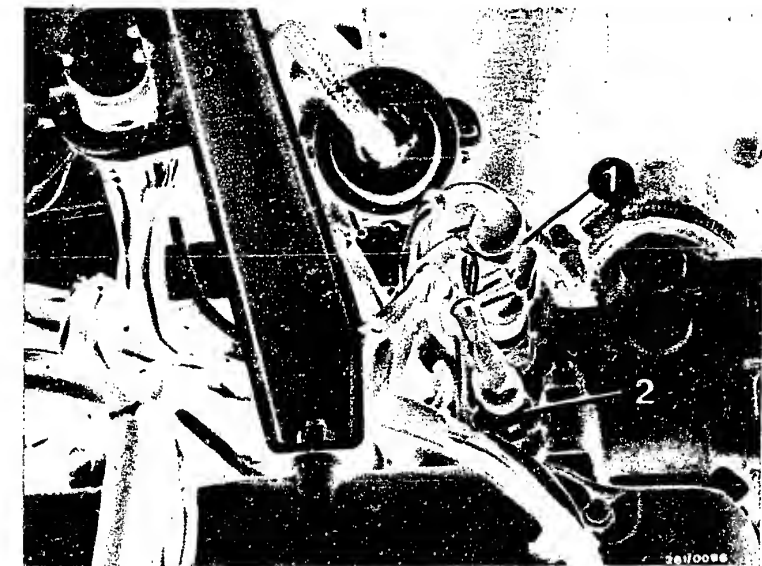
Uneven engine idle

BMW 6 and 7 series with elec. trans.



Uneven engine idle, speed adjustment (idle) and exhaust-gas adjustment (continued)

Test specification: Within one minute max. 1 drop may form at the mouth of the valve.  
Caution!: After testing is completed, refit pipe piece between air filter and air-flow sensor.  
Check connection for leaks and check ground lead on air-flow sensor.



- 1 = Start valve
- 2 = Auxiliary-air device
- 3 = Idle-speed-adjusting screw

Yes

Continued on H7/H8

**H5**

Uneven engine idle

BMW 6 and 7 series with elec. trans.



**H6**

Uneven engine idle

BMW 6 and 7 series with elec. trans.



Uneven engine idle, speed adjustment (idle) and exhaust-gas adjustment  
(continued)

Yes

Solenoid-operated injection valves:

1. Mechanically O.K.?
2. O-rings O.K. (Unmetered air)?

no

1. With the engine running, remove injection-valve connectors individually, one after the other, from the injection valves and plug on again. Engine speed must drop if injection valve is O.K. If not, replace injection valve.

2. Defective O-rings at the protection sleeve lead to unmetered air and thus to a leaning of the mixture.

Defective O-rings at the fuel-distribution pipe connection lead to leaks.

After removing the injection valves, always replace both O-rings.

Removing the injection valves

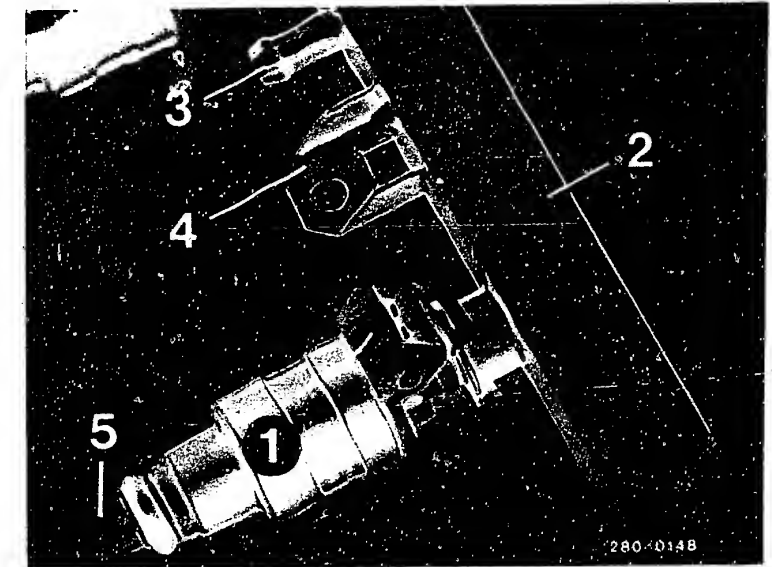
Loosen fastening screws on fuel-distribution pipe. Pull fuel-distribution pipe upward until the injection valves are out of the bore in the intake manifold. Do not damage the nozzle needle. Check nozzle needle and surrounding area for leaks and deposits. Remove electrical connector. Carefully withdraw holding clamps out of groove and pull injection valve out of fuel-distribution pipe connection.

Yes

Continued on H11/H12

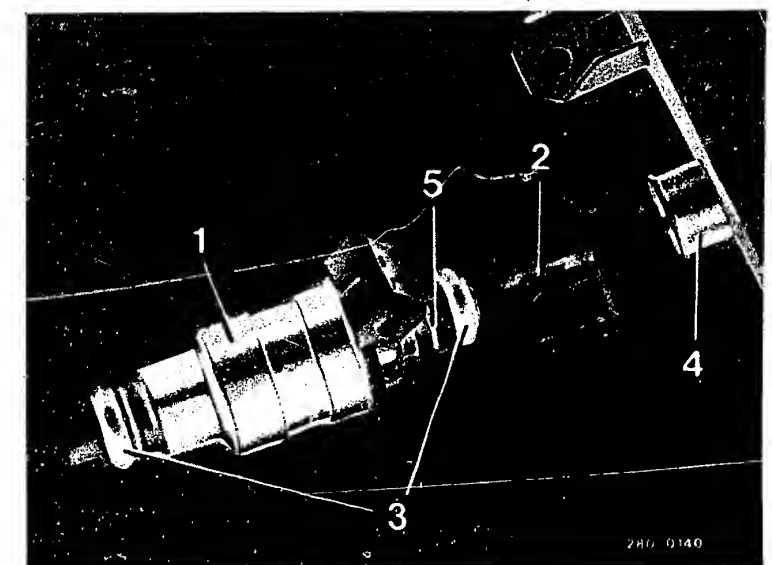
Yes

Continued on H9/H10



- 1 = Injection valve
- 2 = Fuel-distribution pipe
- 3 = Connection to start valve
- 4 = Mounting bracket
- 5 = Protection sleeve

- 1 = Start valve
- 2 = Holding clamp
- 3 = Rubber seal
- 4 = Fuel-distribution pipe connection
- 5 = Groove



**H7**

Uneven engine idle

BMW 6 and 7 series with elec. trans.



**H8**

Uneven engine idle

BMW 6 and 7 series with elec. trans.



Uneven engine idle, speed adjustment (idle) and exhaust-gas adjustment (continued)

Continued  
Installing the injection valves

Caution! Catch any escaping fuel. Do not allow to drip onto hot parts of the engine.  
Carefully lever off protection sleeve (using screwdriver or similar).

Caution! Do not damage projecting injection valve needle. Lift off both O-rings and remove supporting plate.

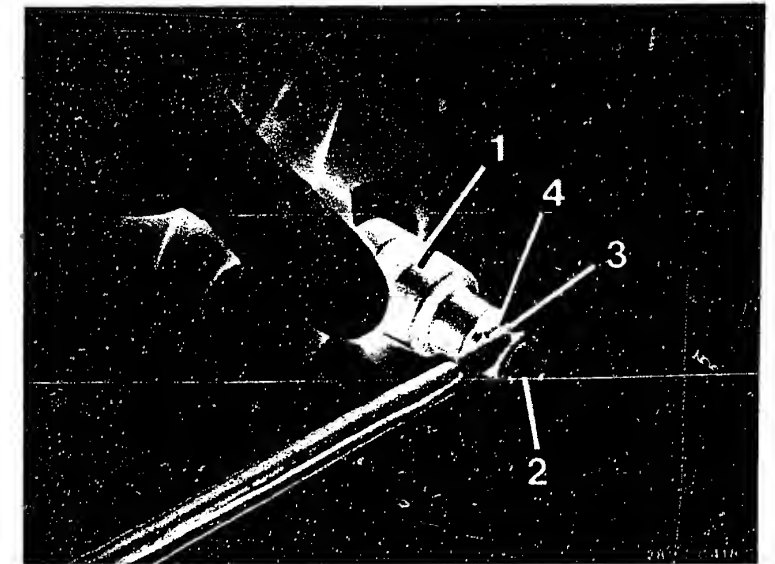
Use parts set 1 287 010 704. Slip on supporting plate. Fit both O-rings and carefully press on new protection sleeve using user-fabricated pipe-piece (approx. 120 mm long and with inside diameter of 10 mm). Do not damage injection valve needle.

Check both rubber seals for proper seating. Simultaneously press all 6 injection valves with the fuel-distribution pipe into their seats. Screw down fuel-distribution pipe. Check all air and fuel hoses for proper seating.

Make electrical connections. Start engine and check whether any unmetered air is being drawn in, and check that injection valves do not leak at fuel-distribution pipe connection.

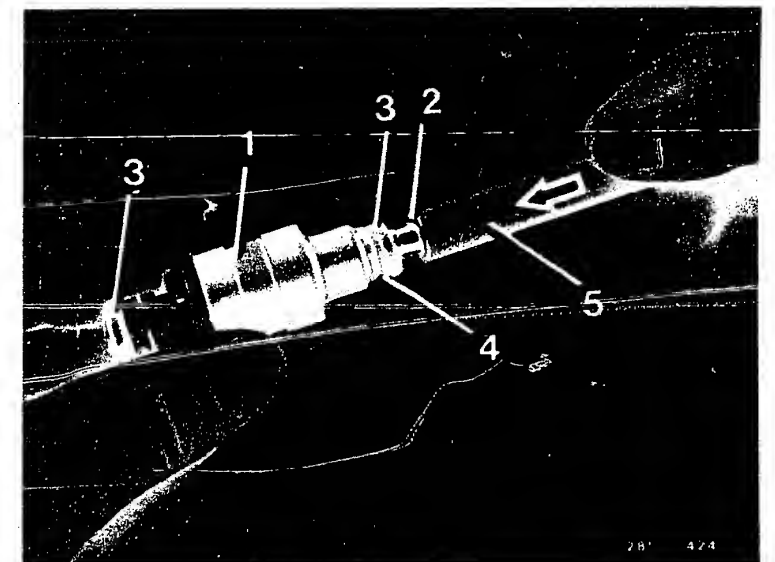
Yes

Continued on H11/H12



- 1 = Injection valve
- 2 = Protection sleeve
- 3 = O-ring
- 4 = Supporting plate

- 1 = Injection valve
- 2 = New protection sleeve
- 3 = O-ring
- 4 = Supporting plate
- 5 = Pipe-piece



H9

Uneven engine idle  
BMW 6 and 7 series with elec. trans.



H10

Uneven engine idle  
BMW 6 and 7 series with elec. trans.



# Uneven engine idle, speed adjustment (idle) and exhaust-gas test (continued)

Yes

Idle speed with engine at operating temperature,  
750 ... 850 min<sup>-1</sup>

Japan:  
800 ... 900 min<sup>-1</sup>

Exhaust-gas specification with engine at operating temperature:  
1.0 ... 1.5 vol. %CO

S/CH/AUS:  
0.6 ... 1.0 vol. %CO

Japan:  
0.45 ... 0.65 vol. %CO  
(Measurement before cat. conv.)

No

- Set idle speed at idle adjustment screw in throttle-valve fitting.
- Adjust exhaust gas with idle-mixture-adjusting screw (hexagon-socket-head AF 5) in air-flow sensor. To do this, remove plug.

If CO cannot be adjusted:

- CO concentration too low: Repeat leak test on air-intake system.
- CO concentration too high: Replace air-flow sensor.

Note: Use new plug (red) in air-flow sensor after CO adjustment.

- If CO or idle speed cannot be adjusted: check knock-control per special SIS microcard.

Yes

Testing completed for customer complaint

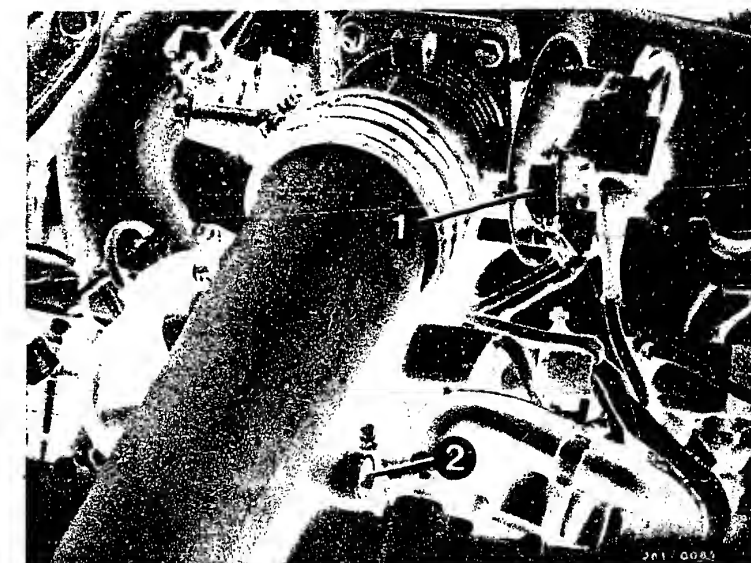
"Uneven engine idle, speed adjustment (idle) and exhaust-gas adjustment"

Customer complaint remedied?

No

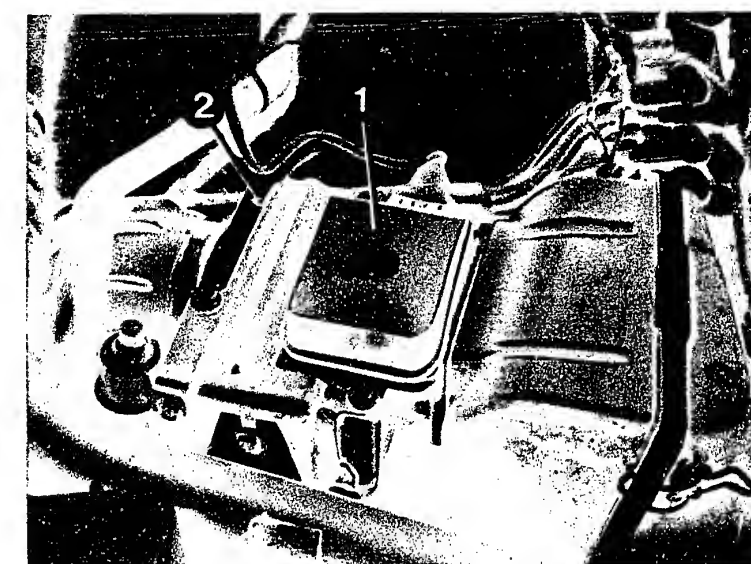
Further possibilities:

- Customer complaint incorrectly diagnosed (see Coordinates B3...B10). If the fault has not been detected by "direct trouble-shooting", see "detailed trouble shooting" (Coordinates B3/B4)
- Engine not mechanically O.K. (compression, valve setting, valve timing, worn camshaft).



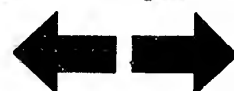
1 = Microswitch  
2 = Idle-speed-adjusting screw

1 = Air-flow sensor with NTC I  
2 = Idle-mixture-adjusting screw



H11

Uneven engine idle  
BMW 6 and 7 series with elec. trans.



H12

Uneven engine idle  
BMW 6 and 7 series with elec. trans.



## Trouble-shooting program according to customer complaints

### How to use the following trouble-shooting program

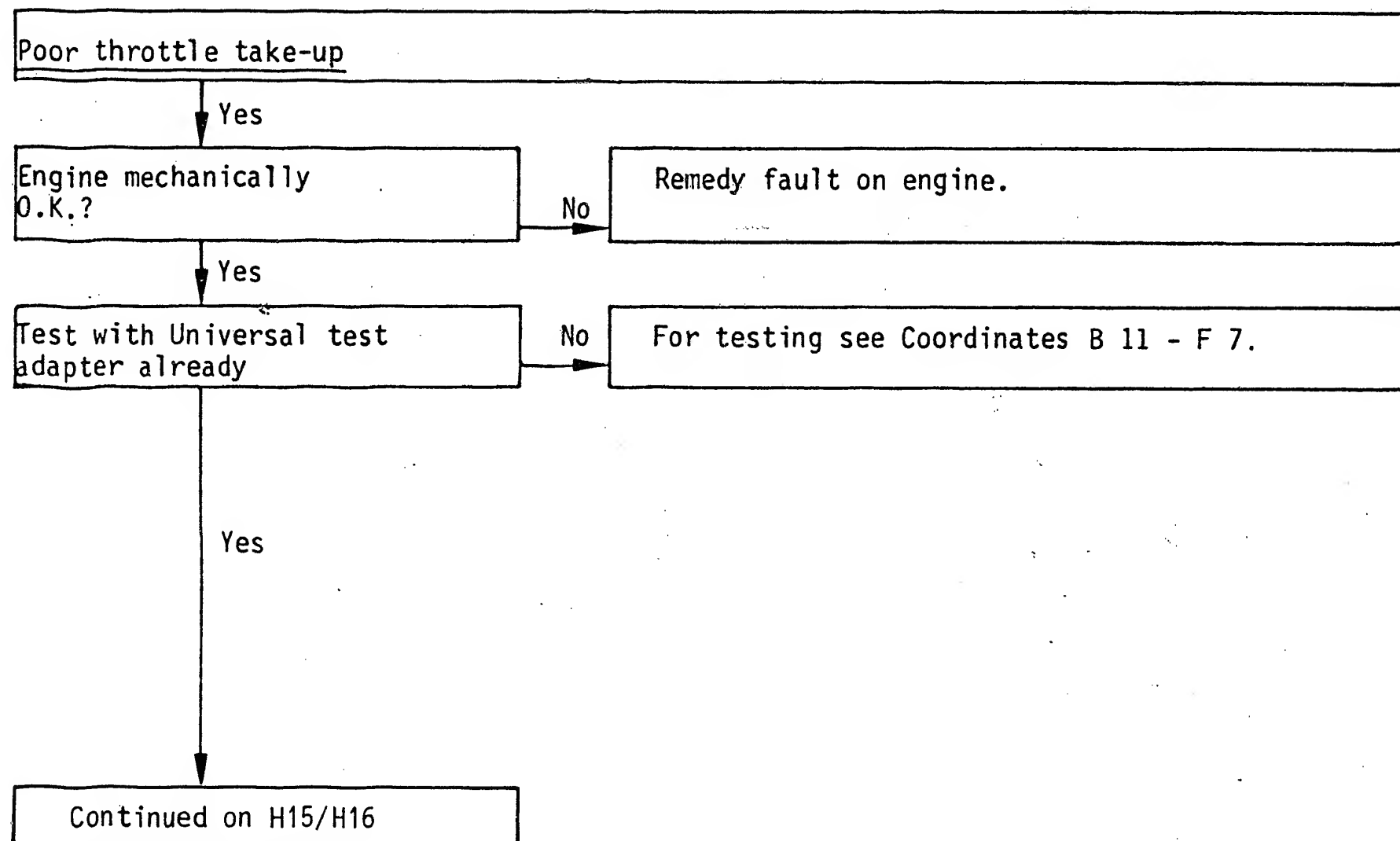
The program is divided into 3 rows of boxes:

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2. The middle row contains descriptions of the testing and adjustment operations on the components.
3. The right-hand row contains the illustrations belonging to the text and explains the illustrations.

If the questions can be answered conclusively with "yes" without testing, proceed to the next question below.

If, on the other hand, the answer to the question is "no", and you suspect a fault, branch to the middle row of boxes and carry out the tests given there.

When you have finished testing continue trouble-shooting at the point at which you branched off.



**H13**

Poor throttle take-up  
BMW 6 and 7 series with elec. trans.



**H14**

Poor throttle take-up  
BMW 6 and 7 series with elec. trans.





# Poor throttle take-up (continued)

Yes

Check secondary pattern of all cylinders.  
Secondary pattern O.K.?

No

Check ignition coil and high-voltage section:  
Distributor cap oil-fouled inside and outside?  
(Remove distributor rotor and check camshaft seal).

Note:

The distributor cap is fastened with 3 screws. To remove the distributor cap, it is necessary to remove the radiator cover.

When plugging on the H.T. ignition cables, pay attention to the cylinder numbers. Do not forget the cap and screening cover.

Check ignition coil primary for continuity (approx. 0  $\Omega$ ). Secondary resistance: 5...7.2 k $\Omega$ . Test interference-suppression resistors, H.T. ignition cables and spark plugs.

Interference-suppression resistor in

Distributor rotor: 1 k $\Omega$

Distributor domes: 1 k $\Omega$  each

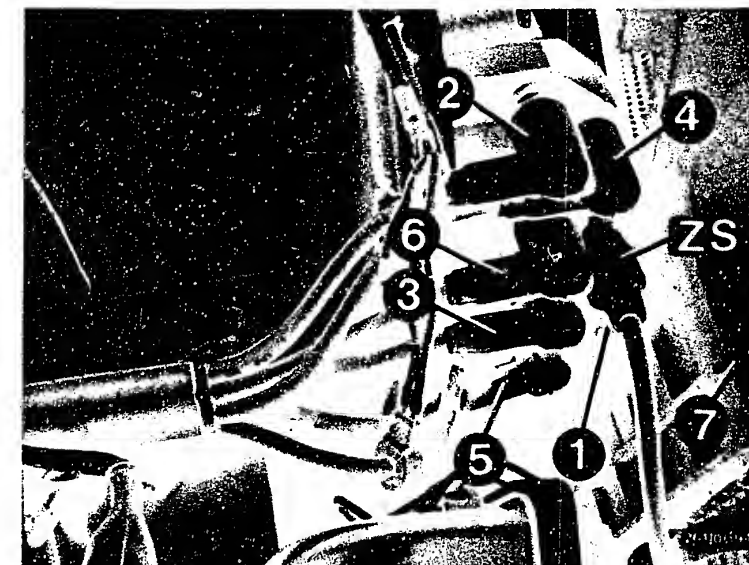
Spark-plug connector: 5 k $\Omega$  each

Spark plugs: 0 k $\Omega$

Ignition coil: 1 k $\Omega$

Yes

Continued on H 17/H 18



High-voltage distributor

1 to 6 = cylinder numbers

ZS = High-tension lead to ignition coil

7 = Radiator cover

1 = Distributor rotor

Arrows = Fastening screws



H15

Poor throttle take-up.

BMW 6 and 7 series with elec. trans.



H16

Poor throttle take-up

BMW 6 and 7 series with elec. trans.



## Poor throttle take-up (continued)

Yes

Throttle valve closed?

No

Yes

Continued on H19/H20

### Testing:

Check whether the throttle valve can be closed still further and whether the engine speed thereby drops.

### Visual examination:

Loosen hose clamp and push back charge-air tube. Throttle valve set to hair's breadth gap? If necessary, adjust at connecting plate.

After correcting, re-adjust throttle cable, micro-switch and potentiometer (part of knock control).

### Adjusting the microswitch:

Slightly loosen fastening screws. Connect ohmmeter to microswitch. Turn operating lever to "full throttle" and slowly return to idle stop. Turn microswitch until idle contact (microswitch) can be heard to switch (reading  $0\ \Omega$ ). Tighten screws.

### Checking the adjustment:

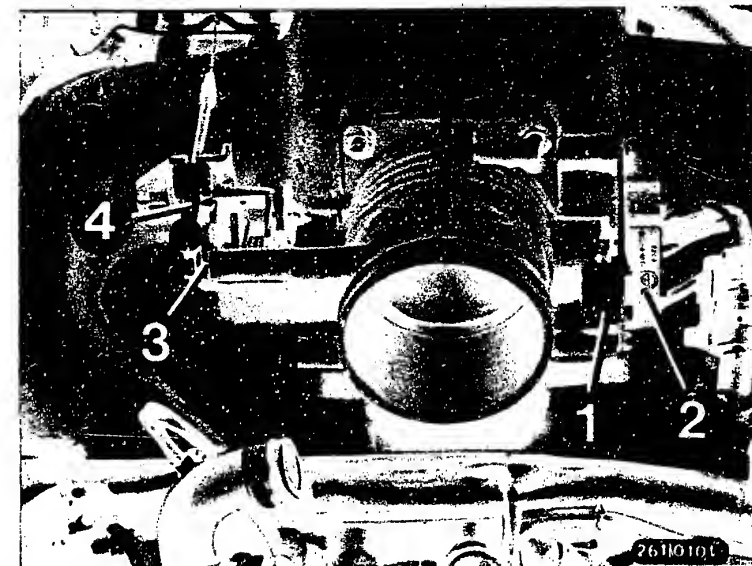
Pull slightly on throttle cable. The idle contact must be heard to switch (reading  $\infty\ \Omega$ ).

### Trouble-shooting:

Test the following leads for continuity using ohmmeter (set value approx.  $0\ \Omega$ ):

- From control unit plug term. 2 to microswitch.
- From microswitch to ground terminal.

Eliminate contact resistances in the plug-in connections.



- 1 = Microswitch
- 2 = Potentiometer
- 3 = Connecting plate
- 4 = Throttle cable

**H17**

Poor throttle take-up  
BMW 6 and 7 series with elec. trans.



**H18**

Poor throttle take-up  
BMW 6 and 7 series with elec. trans.



Yes

Air-flow sensor mechanically OK?

no

Testing:

Open air-flow sensor flap by hand. It must be possible to open the air-flow sensor flap with uniform ease to its fully open position, and it must return to its fully closed position by itself. When opening, the flap must not catch. Watch for signs of abrasion! Clean inside of air-flow sensor if it is very dirty and wipe out with a lint-free cloth. If there are any signs of abrasion, replace the air-flow sensor.

Potentiometer testing (noise test)

Remove air-flow sensor. Leave connector plugged in. Set motortester to "special input" and connect air-flow sensor term. 7 (red clip) and term. 6 (black clip). Set control lever for framing on motortester to left-hand stop (calibrated adjustment). Switch on ignition.

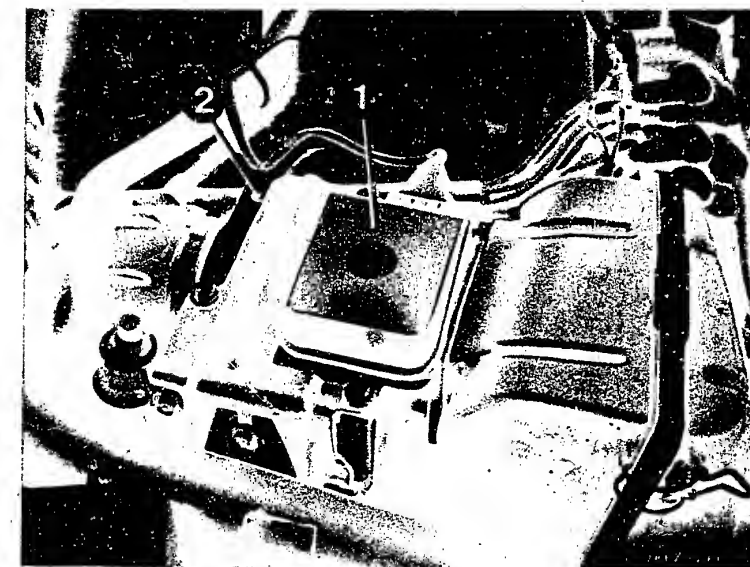
Quickly (jerkily) deflect air-flow sensor flap several times.

If the air-flow sensor is OK, the oscilloscope will show a stroke signal without breaks.

If the air-flow sensor is defective, there will appear a noise signal similar to the adjacent illustration. Replace air-flow sensor.

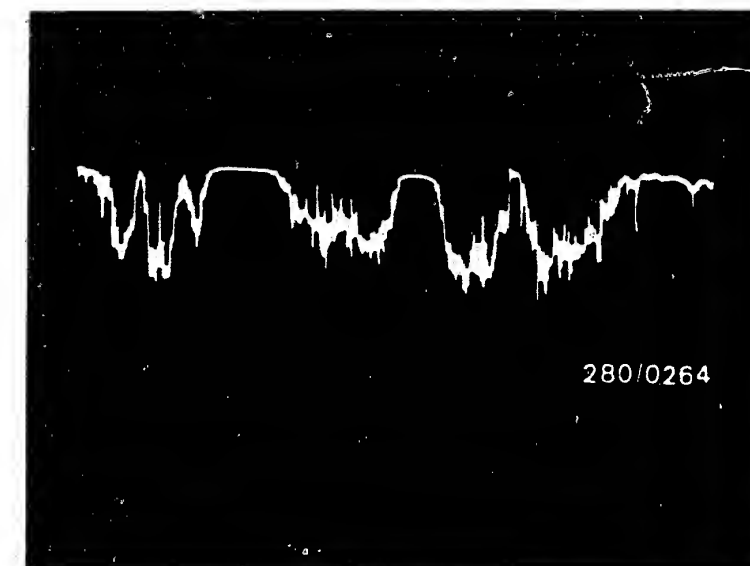
Yes

Continued on H21/H22



1 = Air-flow sensor with NTC I  
2 = Idle-mixture-adjusting screw

Noise signal with defective air-flow sensor



280/0264



## Poor throttle take-up (continued)

Yes

Are all hose lines and electric leads securely attached?  
Visual examination.  
Is the air-intake system leak-tight?

no

Check whether hoses of air-intake system and of fuel line system are securely attached, not kinked or damaged. If necessary, replace hoses.

Eliminate leaks with new seals or by re-tightening the connecting screws.

Checking for leaks: Seal off exhaust tail pipe.

Remove air-filter element and seal off air-flow sensor duct.

Unscrew hose to auxiliary-air device at pipe section and blow air (approx. 0.3 bar gauge pressure) into the pipe section with compressed-air gun.

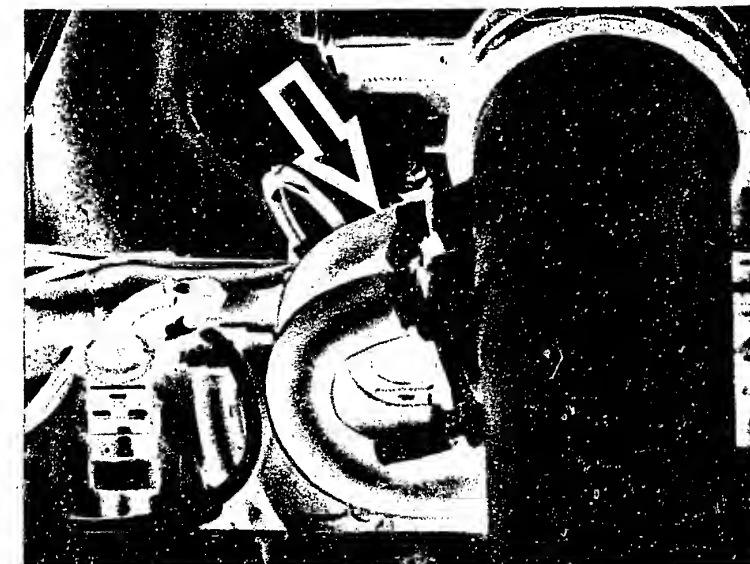
Seal off auxiliary-air device connection. Open throttle valve all the way. Brush or spray on leak-detector spray or soapy water at all sealing joints.

Bubbles or foam indicate leakage.

Check electrical contacts for loose contacts.

Yes

Continued on H23/H24



Arrow = Hose to auxiliary-air device

**H21**

Poor throttle take-up

BMW 6 and 7 series with elec. trans.



**H22**

Poor throttle take-up

BMW 6 and 7 series with elec. trans.



## Poor throttle take-up (continued)

Yes

Auxiliary-air device tested?

No

### Testing (mechanical):

1. Visual examination of auxiliary-air device:  
Remove hoses and look down, using a small mirror. When cold, the device must be open; when the engine is warm it must be closed. If not, replace auxiliary-air device.

2. Functional test of auxiliary-air device:  
With the engine cold, pinch off hose to auxiliary-air device. Engine speed must drop. With the engine warm, pinch off hose to auxiliary-air device. Engine speed must not drop. If incorrect, replace auxiliary-air device (pay attention to direction of flow).

### 3. Electrical test

Disconnect the plug of the auxiliary-air device. Connect ohmmeter to both terminals of the auxiliary-air device.

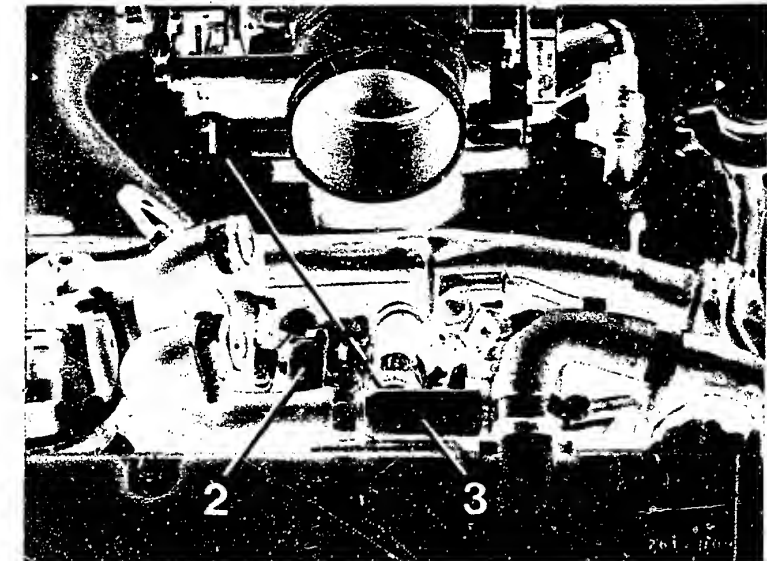
Test value

30...65Ω

If a value outside the tolerance is shown, replace the auxiliary-air device.

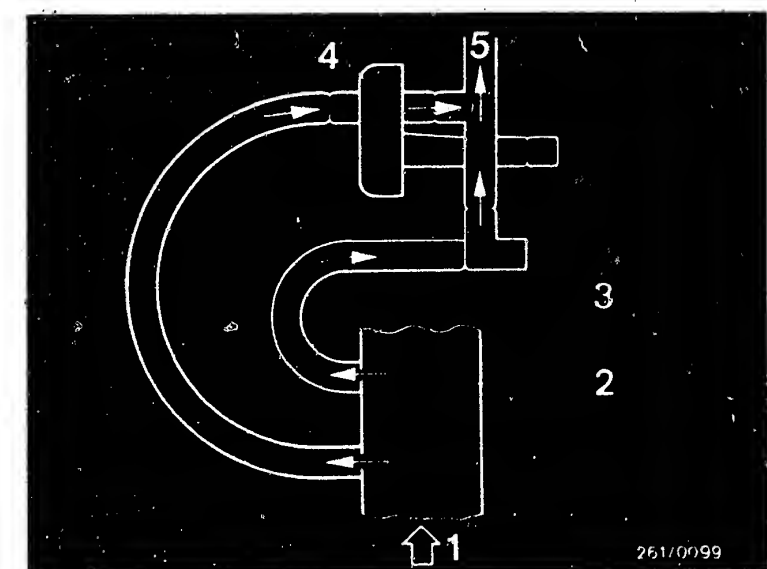
Yes

Continued on J1/J2



- 1 = Start valve
- 2 = Auxiliary-air device
- 3 = Idle-speed-adjusting screw

- 1 = From charge-air cooler
- 2 = Pipe piece
- 3 = Idle-speed-adjusting screw
- 4 = Auxiliary-air device
- 5 = Bypass air to intake manifold



**H23**

Poor throttle take-up

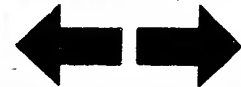
BMW 6 and 7 series with elec. trans.



**H24**

Poor throttle take-up

BMW 6 and 7 series with elec. trans.



Poor throttle take-up (continued)

Yes

Testing completed for customer complaint

"Poor throttle take-up"

Customer complaint remedied?

No

Further possibilities:

- Customer complaint incorrectly diagnosed (See Coordinates B3...B10).  
If the fault has not been detected by "direct trouble-shooting", see "detailed trouble-shooting" (Coordinates B3/B4).
- Engine not mechanically O.K. (Compression, valve setting, valve timing, worn camshaft).

**J1**

Poor throttle take-up

BMW 6 and 7 series with elec. trans.



**J2**

Poor throttle take-up

BMW 6 and 7 series with elec. trans.





## Trouble-shooting program according to customer complaints

### How to use the following trouble-shooting program

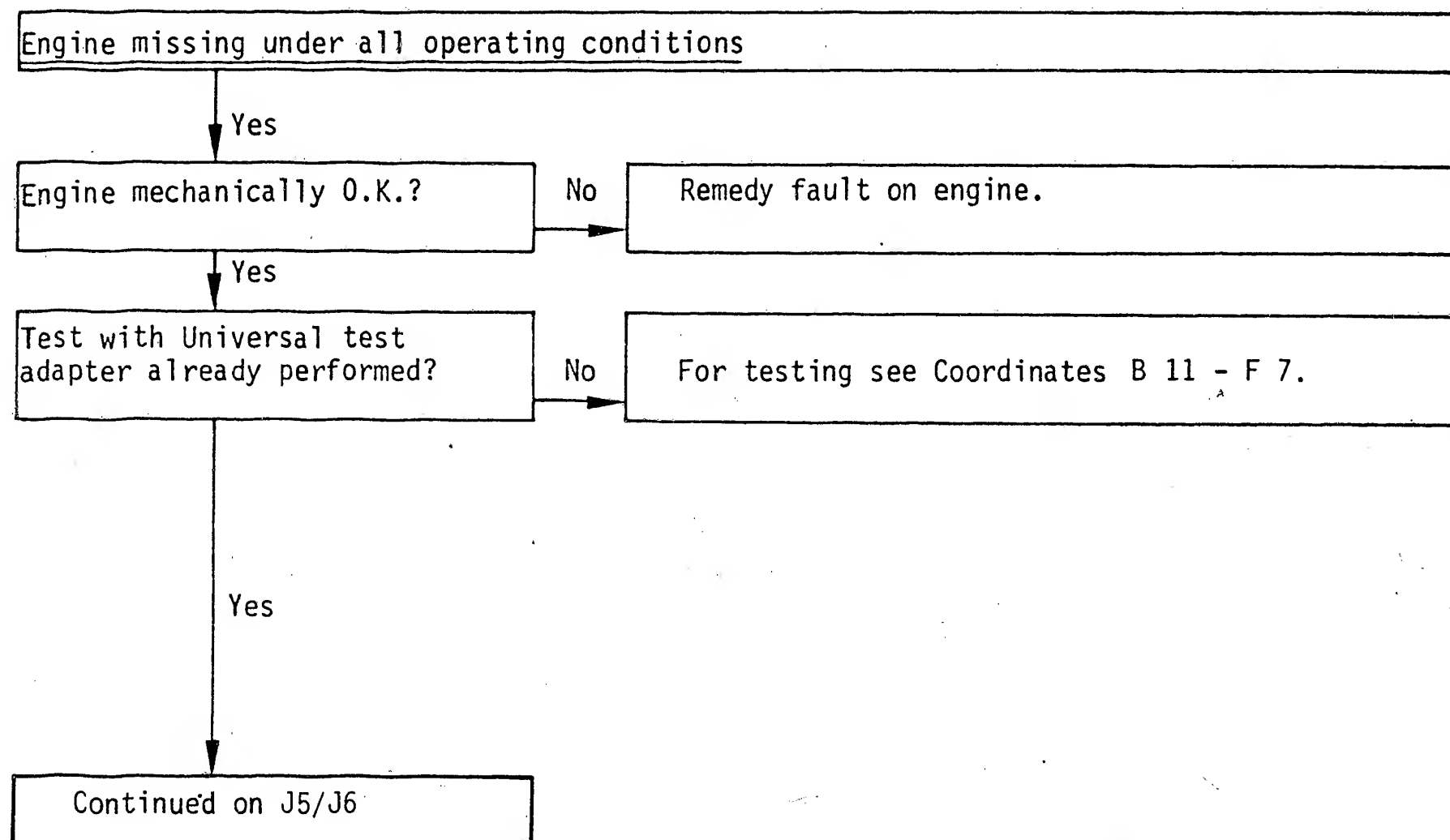
The program is divided into 3 rows of boxes:

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If the questions can be answered conclusively with "yes" without testing, proceed to the next question below.

If, on the other hand, the answer to the question is "no", and you suspect a fault, branch to the middle row of boxes and carry out the tests given there.

When you have finished testing continue trouble-shooting at the point at which you branched off.



**J3**

Engine missing

BMW 6 and 7 series with elec. trans.



**J4**

Engine missing

BMW 6 and 7 series with elec. trans.



# Engine missing under all operating conditions (continued)

Yes

Check secondary pattern of all cylinders.  
Secondary pattern O.K.?

No

Check ignition coil and high-voltage section; distributor cap oil-fouled outside and inside? (Unscrew distributor rotor and check camshaft seal).

Note:

The distributor cap is fastened with 3 screws. To remove the distributor cap, it is necessary to remove the radiator cover. When plugging on the H.T. ignition cables, pay attention to the cylinder numbers. Do not forget the cap and screening cover.

Check ignition coil primary for continuity (approx. 0  $\Omega$ ). Secondary resistance: 5...7.2 k $\Omega$ . Test interference-suppression resistors, H.T. ignition cables and spark plugs.

Interference-suppression resistor in

Distributor rotor:	1 k $\Omega$
Distributor domes:	1 k $\Omega$ each
Spark-plug connector:	5 k $\Omega$ each
Spark plugs:	0 k $\Omega$
Ignition coil:	1 k $\Omega$

Yes

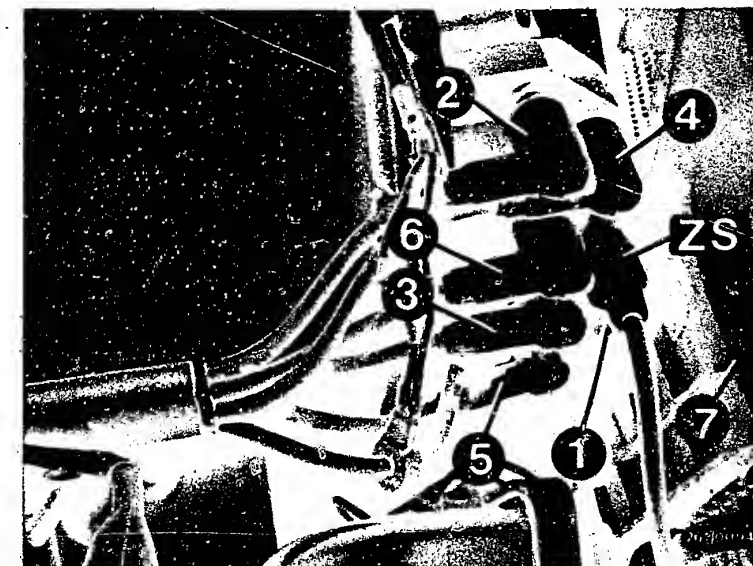
Plug-in connections of wiring harness and ground terminal O.K.?

No

Look for engine missing due to loose contacts as follows: Let the engine run, if possible on a chassis dynamometer. Keep the engine speed constant and watch for engine missing. Move the wiring harness and plug-in connections while doing this. Watch particularly for plug-in connections on engine-speed and reference-mark sensors. Ground terminal firmly secured? Check plug-in connections for security and corrosion. Spring contacts must be clipped in and must not move back. Check ground leads for continuity and loose contacts.

Yes

Continued on J 7/J 8



High-voltage distributor

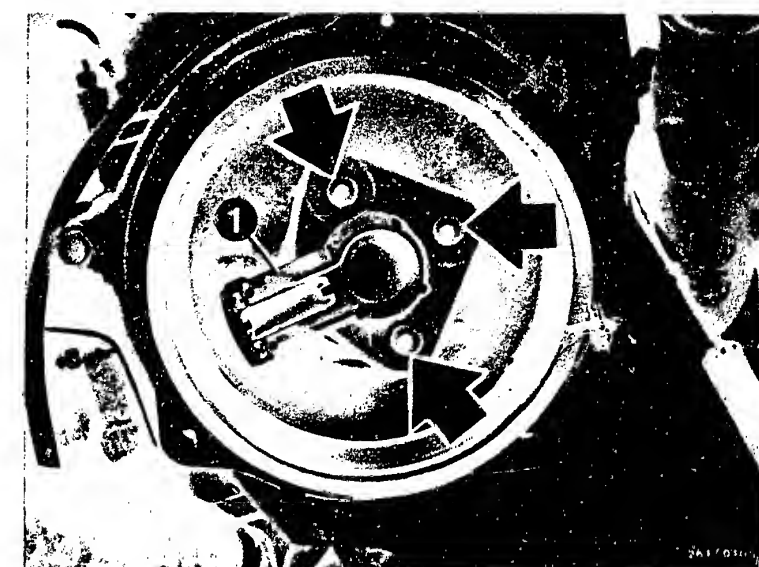
1 to 6 = cylinder numbers

ZS = High-tension lead to ignition coil

7 = Radiator cover

1 = Distributor rotor

Arrows = Fastening screws



J5

Engine missing

BMW 6 and 7 series with elec. trans.



J6

Engine missing

BMW 6 and 7 series with elec. trans.



Engine missing under all operating conditions (continued)

Yes

Air-flow sensor mechanically OK? no

Testing:

Open air-flow sensor flap by hand. It must be possible to open the air-flow sensor flap with uniform ease to its fully open position, and it must return to its fully closed position by itself. When opening, the flap must not catch. Watch for signs of abrasion! Clean inside of air-flow sensor if it is very dirty and wipe out with a lint-free cloth. If there are any signs of abrasion, replace the air-flow sensor.

Potentiometer testing (noise test)

Remove air-flow sensor. Leave connector plugged in. Set motortester to "special input" and connect air-flow sensor term. 7 (red clip) and term. 6 (black clip). Set control lever for framing on motortester to left-hand stop (calibrated adjustment). Switch on ignition.

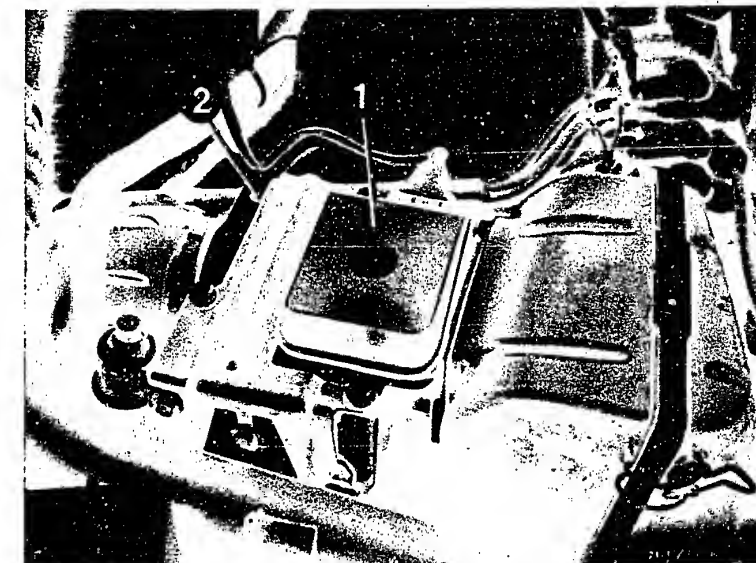
Quickly (jerkily) deflect air-flow sensor flap several times.

If the air-flow sensor is OK, the oscilloscope will show a stroke signal without breaks.

If the air-flow sensor is defective, there will appear a noise signal similar to the adjacent illustration. Replace air-flow sensor.

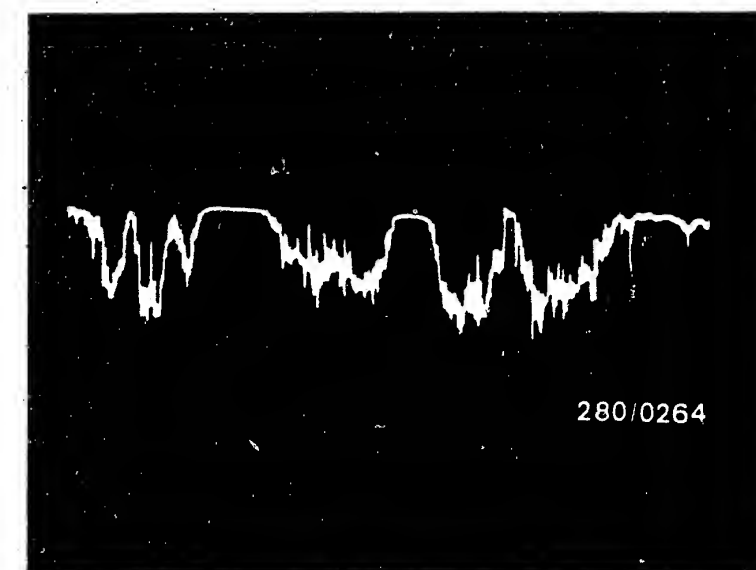
Yes

Continued on J9/J10



1 = Air-flow sensor with NTC I  
2 = Idle-mixture-adjusting screw

Noise signal with defective air-flow sensor



280/0264

J7

Engine missing

BMW 6 and 7 series with elec. trans.



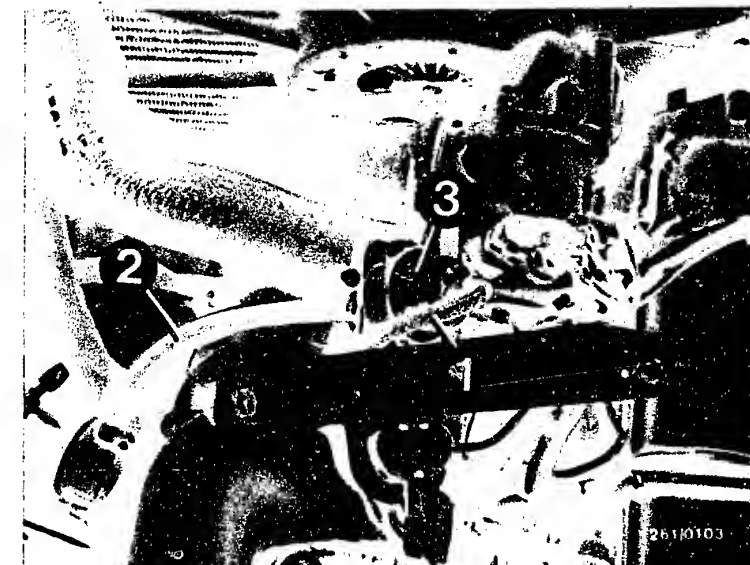
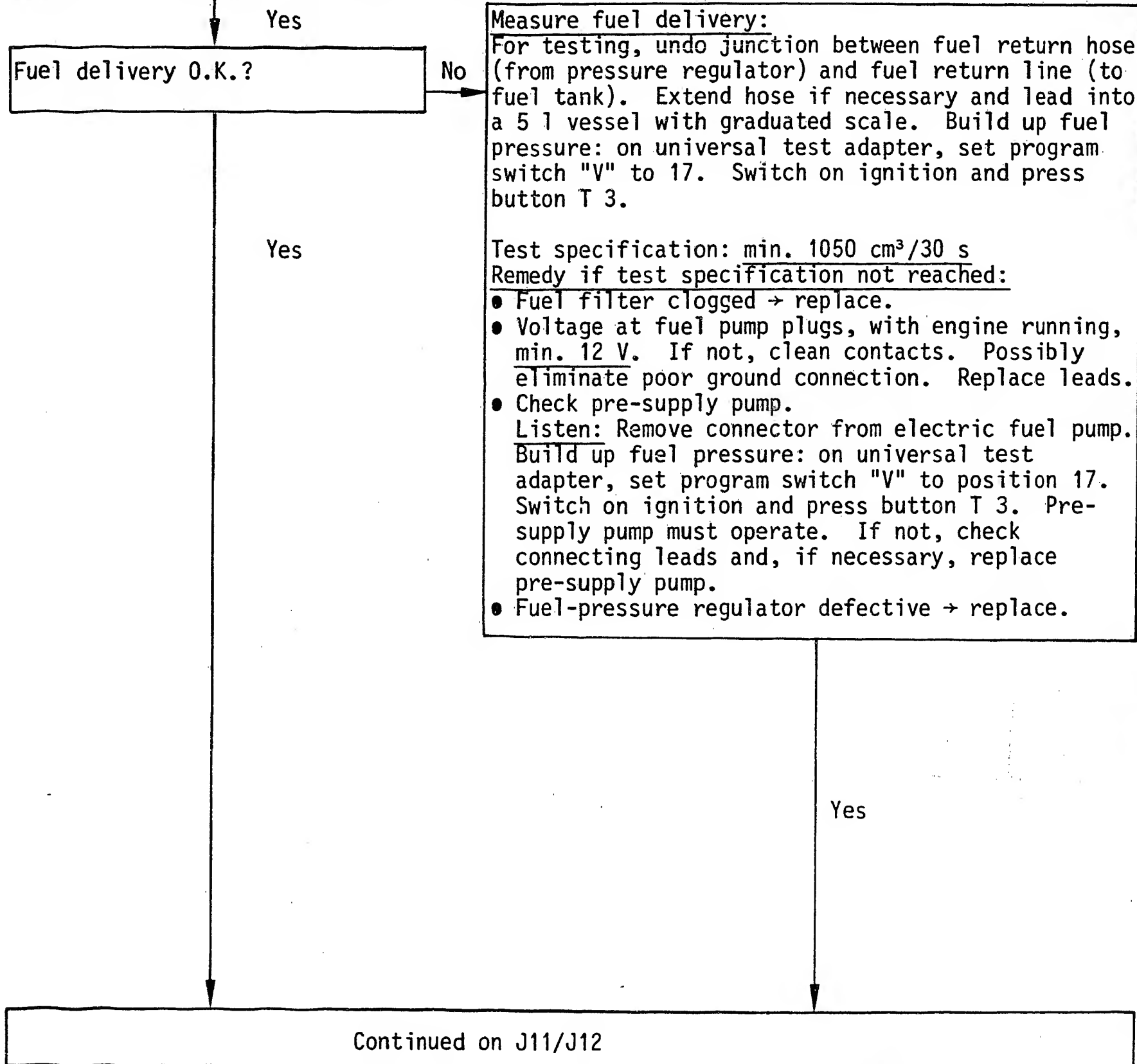
J8

Engine missing

BMW 6 and 7 series with elec. trans.



# Engine missing under all operating conditions (continued)



- 1 = Air hose
- 2 = Fuel return line
- 3 = Pressure regulator

Pre-supply pump: underneath mat in luggage compartment  
1 = Fuel delivery line to electric fuel pump  
2 = Fuel return line  
Arrows = Connector 2-pin pre-supply pump, 3-pin immersion-tube sensor



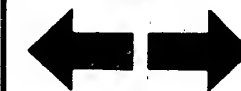
J9

Engine missing  
BMW 6 and 7 series with elec. trans.



J10

Engine missing  
BMW 6 and 7 series with elec. trans.



# Engine missing under all operating conditions (continued)

Yes

- Fuel pump delivery too low → replace fuel pump.
- Strainer in tank clogged?
- Corrosion in tank?

Burbling on the overrun?

No

1. Check exhaust system for leaks.

2. Throttle valve closed?

Check whether the throttle valve can be closed still further and whether the engine speed thereby drops.

Visual examination:

Loosen hose clamp and push back charge-air tube.

Throttle valve set to hair's breadth gap? If necessary, adjust at connecting plate.

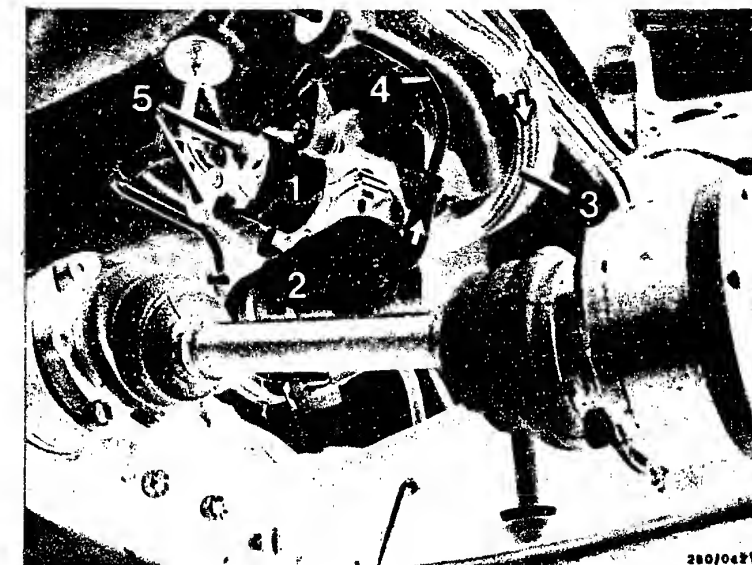
After correcting, readjust throttle cable, microswitch and potentiometer (part of knock control).

After correction has been completed, re-adjust accelerator cable, microswitch, and potentiometer (part of the knock control in the 745i).

Yes

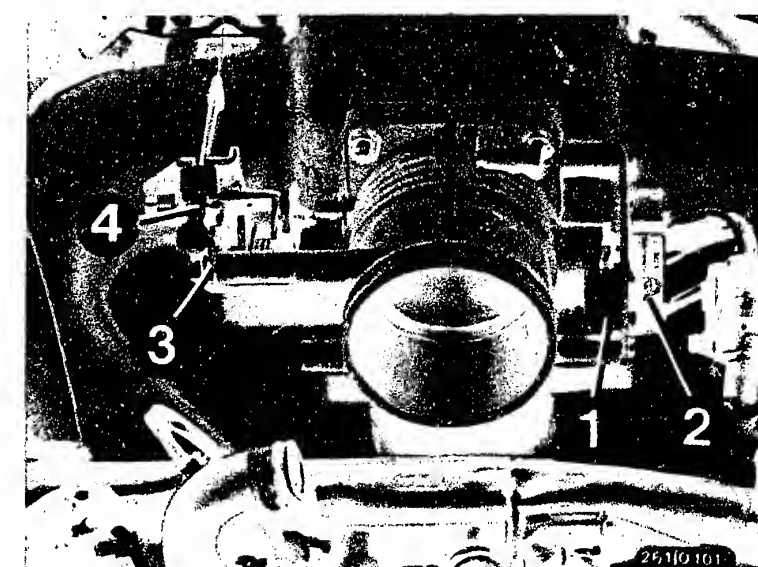
Yes

Continued on J13/J14



- 1 = Fuel pump
- 2 = Fuel filter
- 3 = Fuel intake line
- 4 = Fuel delivery line
- 5 = Electric fuel pump plug
- Arrow = Direction of fuel flow

- 1 = Microswitch
- 2 = Potentiometer
- 3 = Connecting plate
- 4 = Throttle cable



J11

Engine missing

BMW 6 and 7 series with elec. trans.



J12

Engine missing

BMW 6 and 7 series with elec. trans.



Engine missing under all operating conditions (continued)

Adjusting the microswitch:

Slightly loosen fastening screws. Connect ohmmeter to microswitch. Turn operating lever to "full throttle" and slowly return to idle stop. Turn microswitch until idle contact (microswitch) can be heard to switch (reading  $0\ \Omega$ ). Tighten screws.

Checking the adjustment:

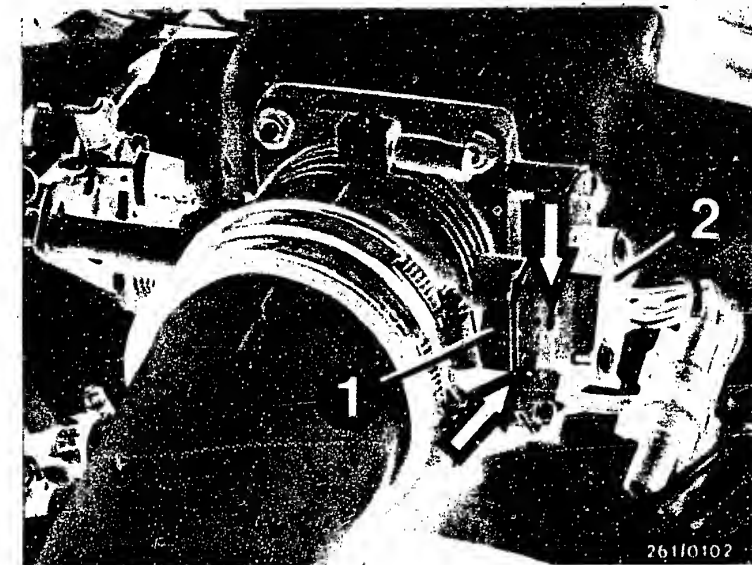
Pull slightly on throttle cable. The idle contact must be heard to switch (reading  $\infty\ \Omega$ ).

Trouble-shooting:

Test the following leads for continuity using ohmmeter (set value approx.  $0\ \Omega$ ):

- From control unit plug term. 2 to microswitch.
- From microswitch to ground terminal.

Eliminate contact resistances in the plug-in connections.



1 = Microswitch

2 = Potentiometer

Arrows = Fastening screws

Control unit O.K.?

No

Let engine run. Lightly shake control unit and move control unit plug, listening for engine misses. Restore plug-in connection on control unit plug to good condition, or replace defective control unit.

Yes

Continued on J15/J16

**J13**

Engine missing

BMW 6 and 7 series with elec. trans.



**J14**

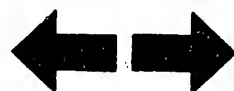
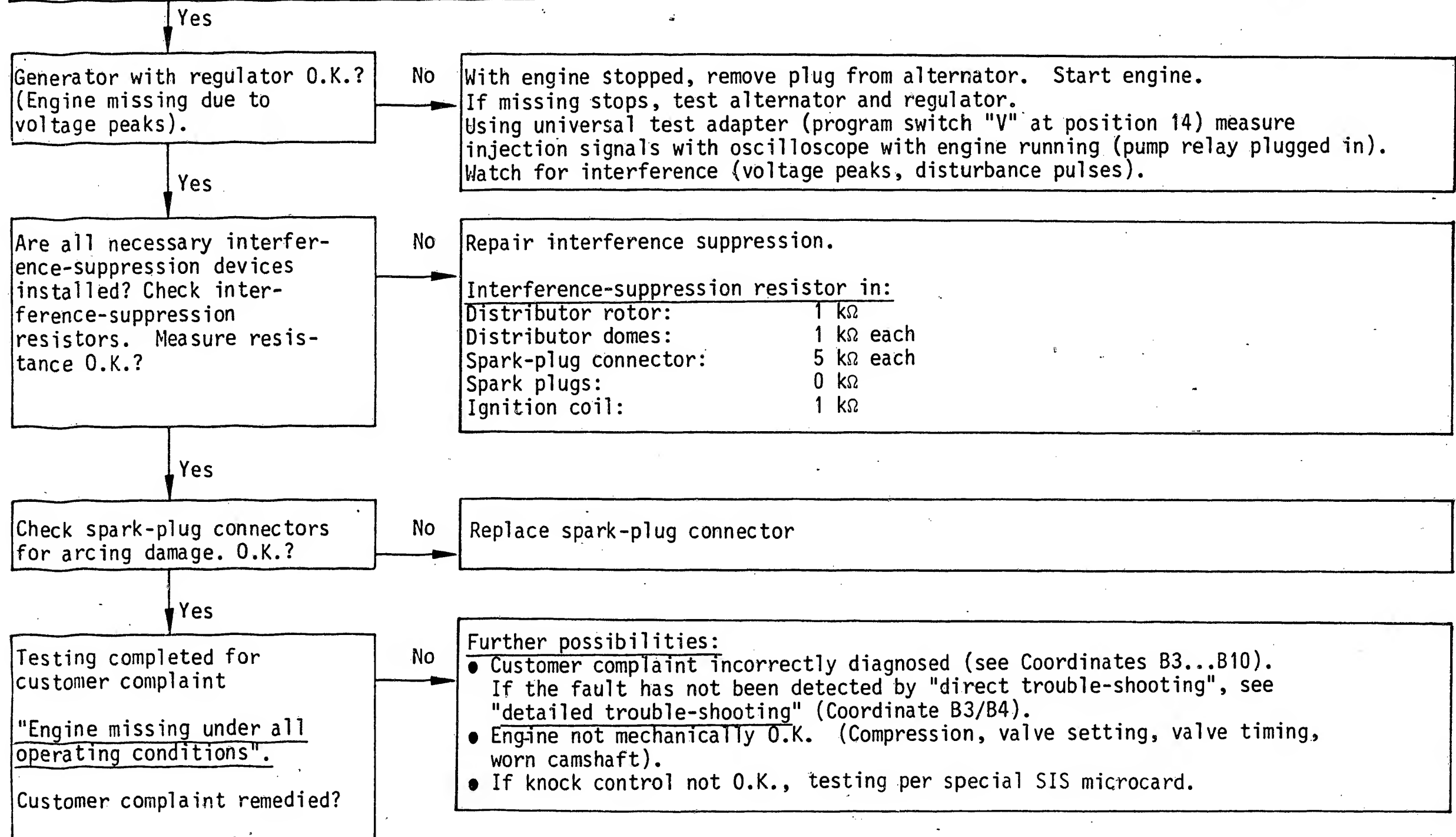
Engine missing

BMW 6 and 7 series with elec. trans.





Engine missing under all operating conditions (continued)



## Trouble-shooting program according to customer complaints

### How to use the following trouble-shooting program

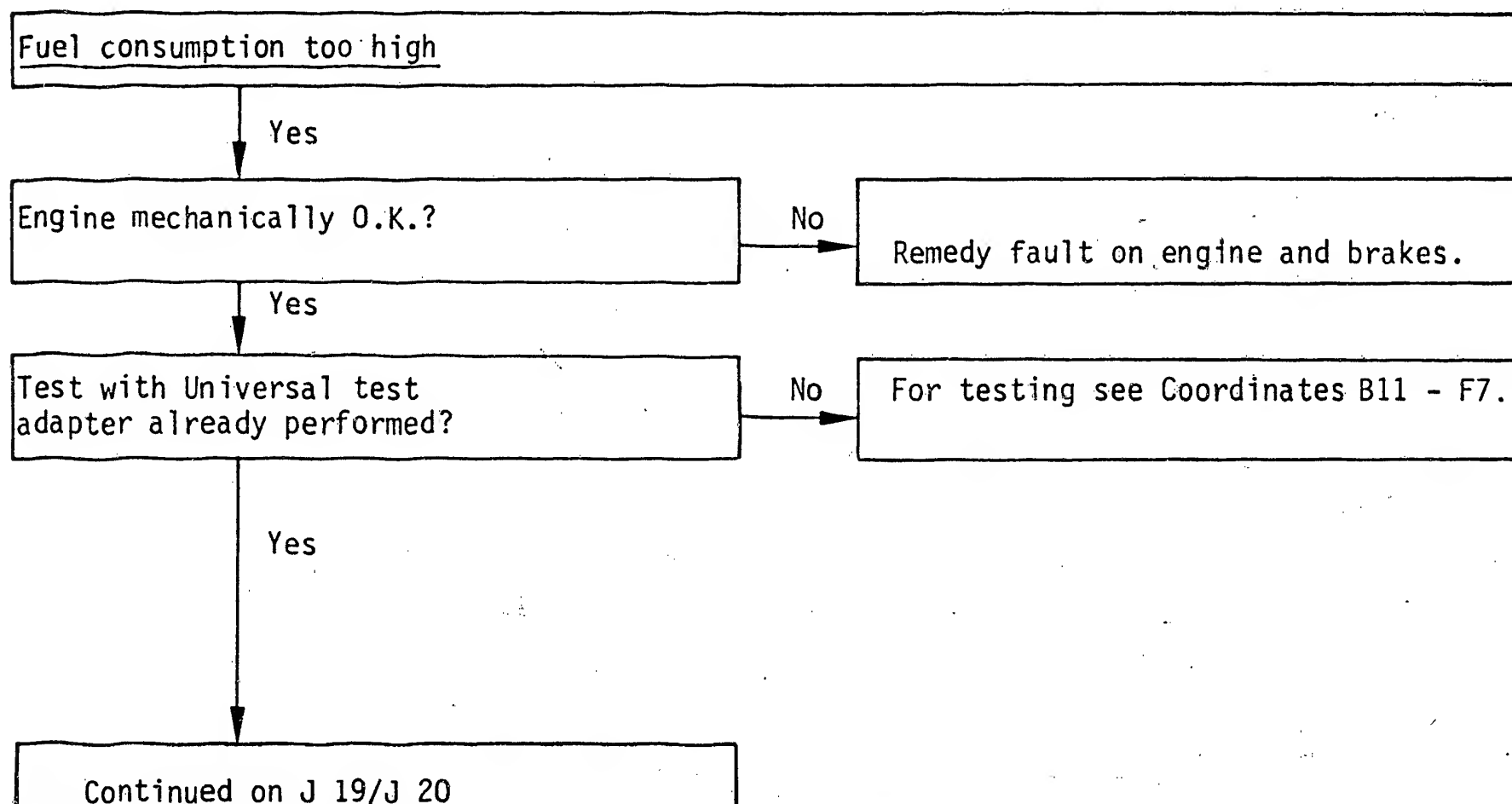
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**J17**

Fuel consumption too high

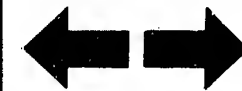
BMW 6 and 7 series with elec. trans.



**J18**

Fuel consumption too high

BMW 6 and 7 series with elec. trans.



# Fuel consumption too high (continued)

Yes

Check secondary pattern of all cylinders. Secondary pattern O.K.?

No

Check ignition coil and high-voltage section; distributor cap oil-fouled outside and inside? (Unscrew distributor rotor and check camshaft seal).

Note:

The distributor cap is fastened with 3 screws. To remove the distributor cap, it is necessary to remove the radiator cover.

When plugging on the H.T. ignition cables, pay attention to the cylinder numbers. Do not forget the cap and screening cover.

Check ignition coil primary for continuity (approx. 0  $\Omega$ ). Secondary resistance: 5...7.2 k $\Omega$ . Test interference-suppression resistors, H.T. ignition cables and spark plugs.

Interference-suppression resistor in

Distributor rotor: 1 k $\Omega$

Distributor domes: 1 k $\Omega$  each

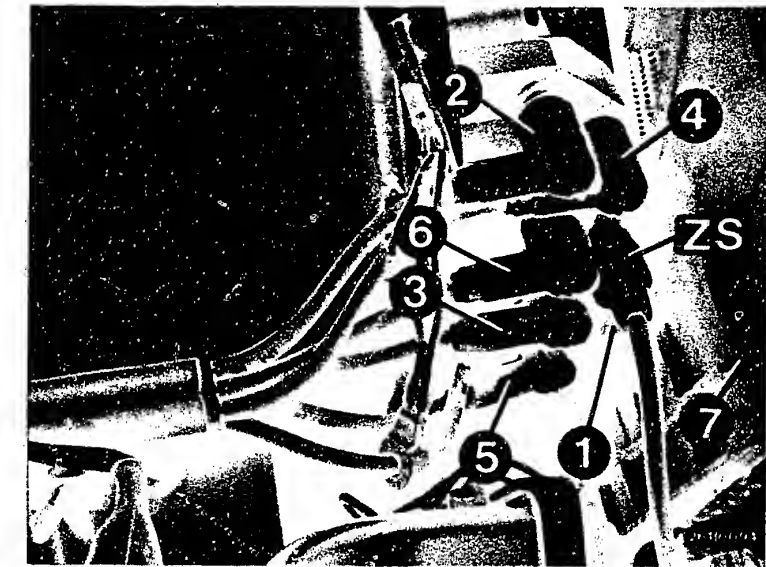
Spark-plug connector: 5 k $\Omega$  each

Spark plugs: 0 k $\Omega$

Ignition coil: 1 k $\Omega$

Yes

Continued on J21/J22



High-voltage distributor

1 to 6 = cylinder numbers

ZS = High-tension lead to ignition coil

7 = Radiator cover

1 = Distributor rotor

Arrows = Fastening screws



J19

Fuel consumption too high

BMW 6 and 7 series with elec. trans.



J20

Fuel consumption too high

BMW 6 and 7 series with elec. trans.



# Fuel consumption too high (continued)

Yes

Have all brakes released fully?

Yes

Start valve O.K.?

no

## Checking the start valve for leaks:

### 1. When installed

Pinch off fuel delivery line to start valve. If engine then runs smoothly, replace start valve.

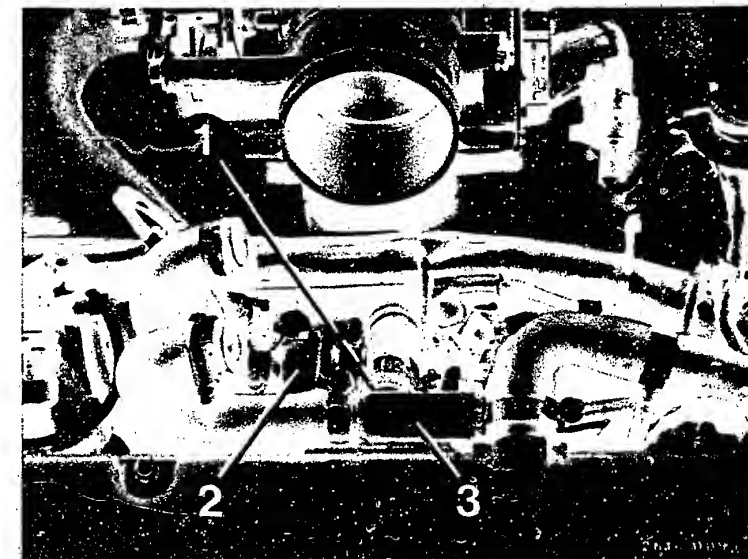
### 2. When removed

Remove start valve (caution - fire hazard!). Fuel line and electric lead remain connected (place collector vessel under start valve). Build up fuel pressure. On universal test adapter, set program switch "V" to position 17. Switch on ignition and press button T 3.

Test specification: Within one minute max. 1 drop may form at the mouth of the valve.

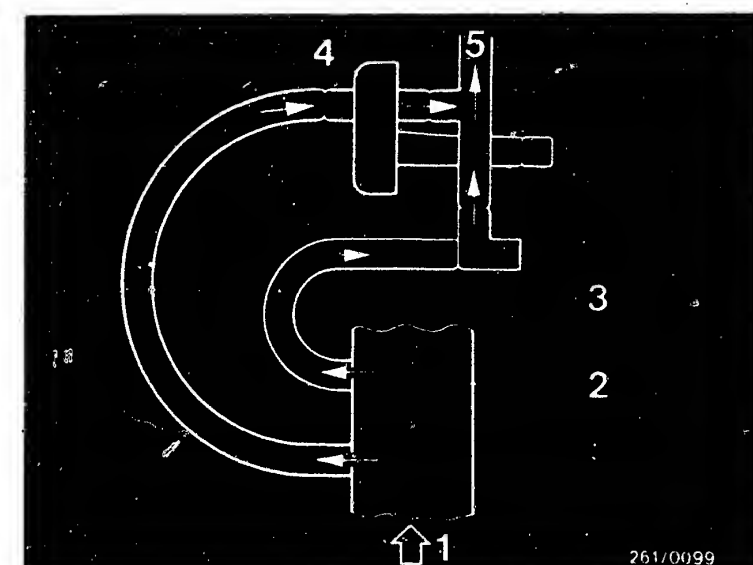
Yes

Continued on J23/J24



- 1 = Start valve
- 2 = Auxiliary-air device
- 3 = Idle-speed-adjusting screw

- 1 = From charge-air cooler
- 2 = Pipe piece
- 3 = Idle-speed-adjusting screw
- 4 = Auxiliary-air device
- 5 = Bypass air to intake manifold



261/0099

J21

Fuel consumption too high

BMW 6 and 7 series with elec. trans.



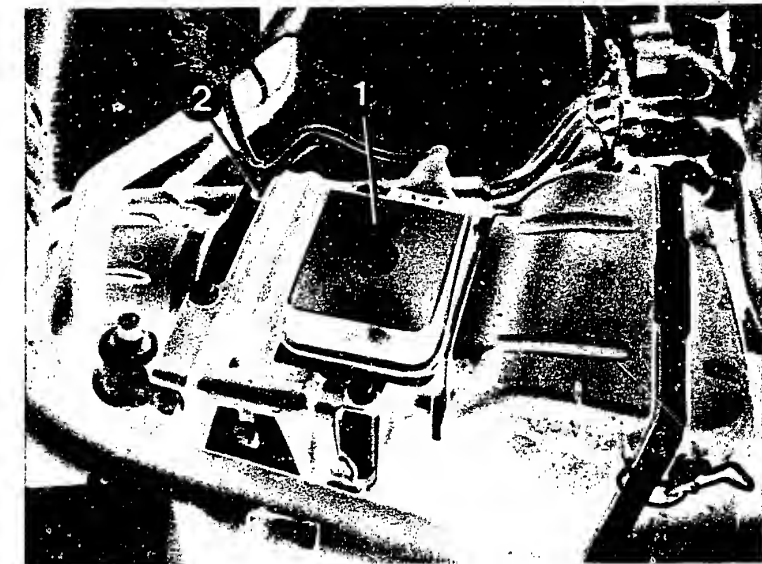
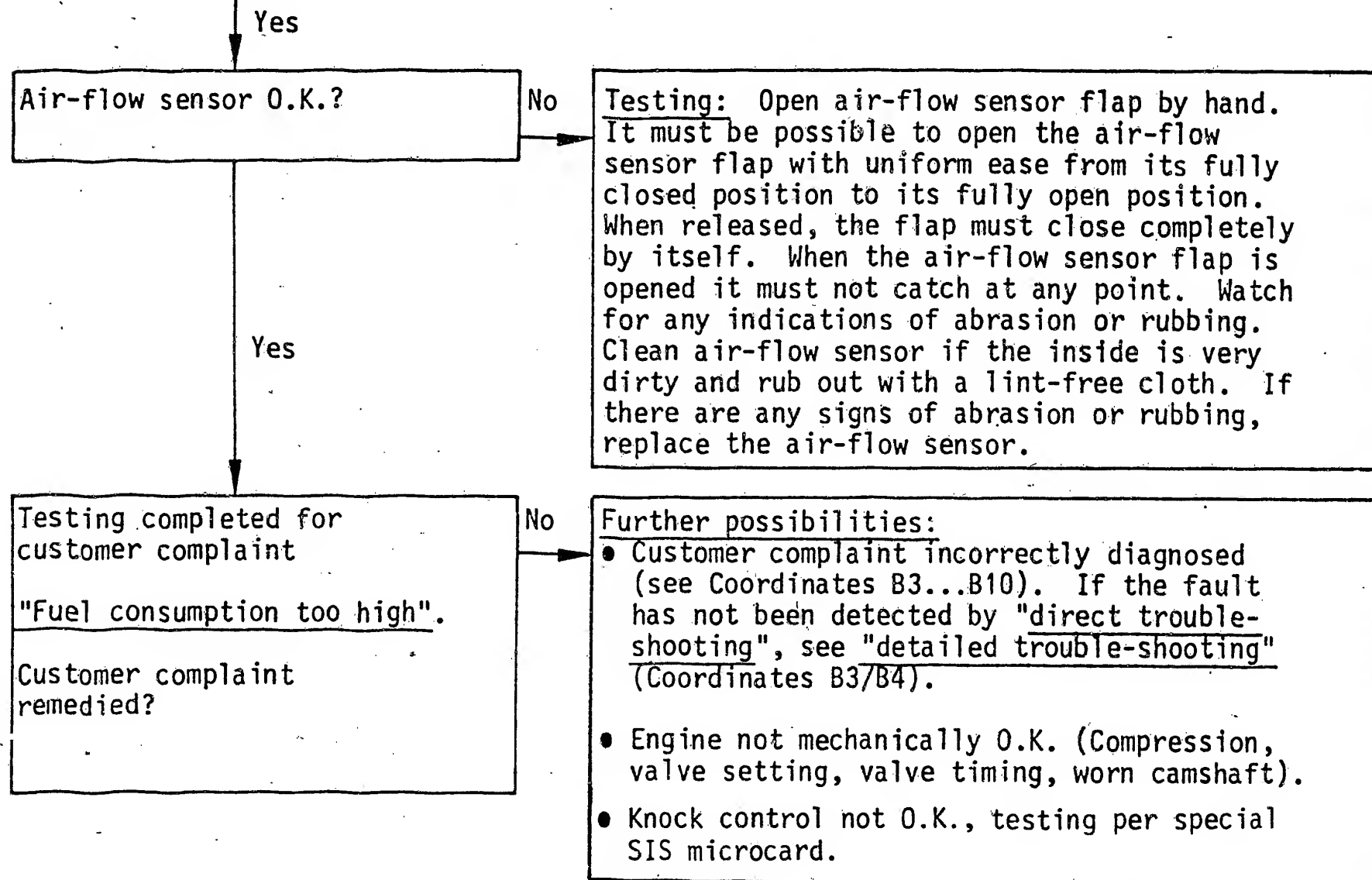
J22

Fuel consumption too high

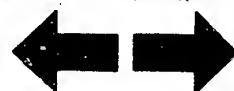
BMW 6 and 7 series with elec. trans.



## Fuel consumption too high (continued)



1 = Air-flow sensor with NTC I  
2 = Idle-mixture-adjusting screw



## Trouble-shooting program according to customer complaints

### How to use the following trouble-shooting program

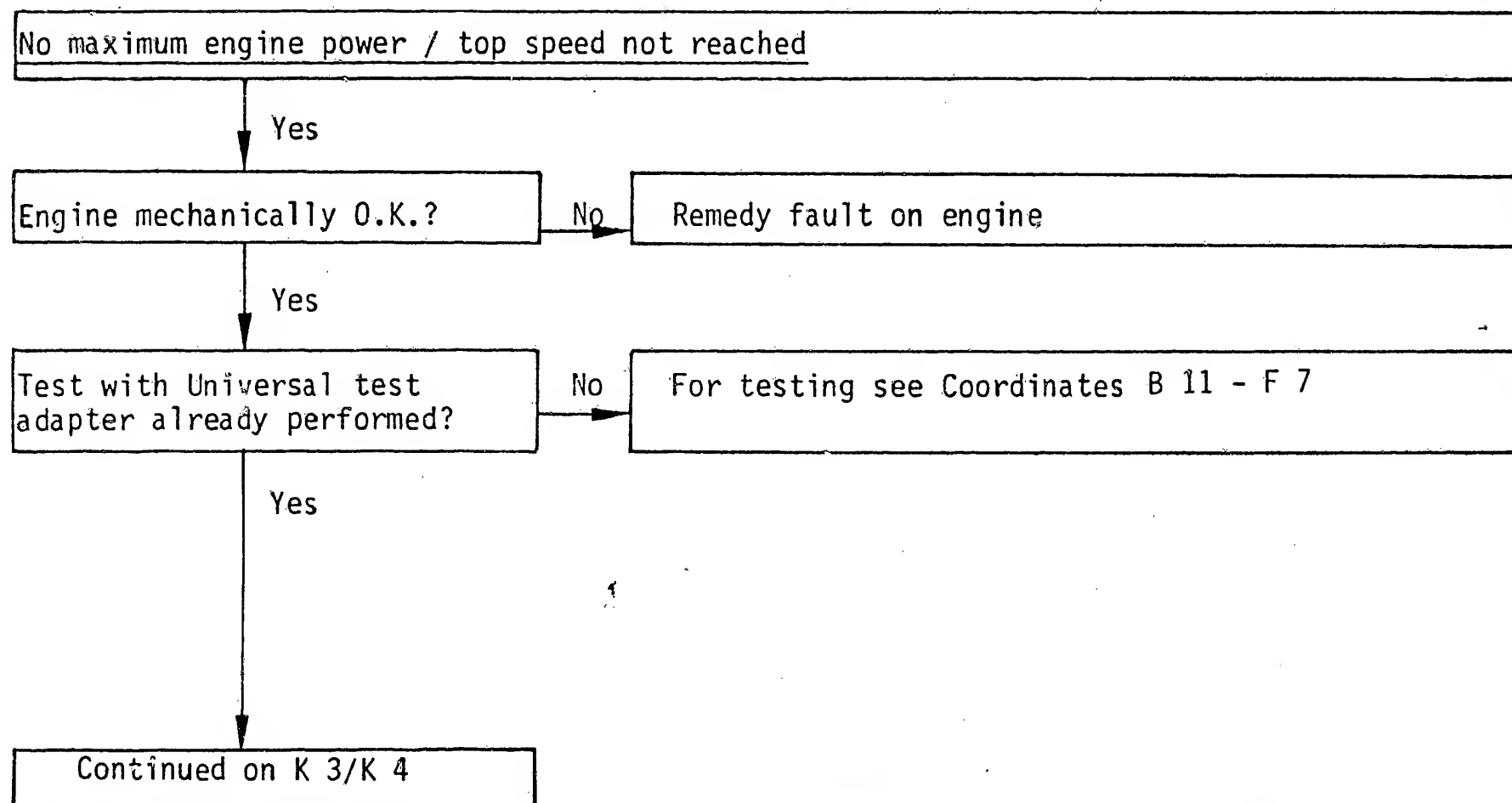
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When you have finished testing continue trouble-shooting at the point at which you branched off.



**K1**

No maximum engine power  
BMW 6 and 7 series with elec. trans.



**K2**

No maximum engine power  
BMW 6 and 7 series with elec. trans.





No maximum engine power / top speed not reached (continued)

Yes

Check secondary pattern of all cylinders.  
Secondary pattern O.K.?

no

Check ignition coil and high-voltage section; distributor cap oil-fouled outside and inside? (Unscrew distributor rotor and check camshaft seal).

Note:

The distributor cap is fastened with 3 screws. To remove the distributor cap, it is necessary to remove the radiator cover.

When plugging on the H.T. ignition cables, pay attention to the cylinder numbers. Do not forget the cap and screening cover.

Check ignition coil primary for continuity (approx.  $0\ \Omega$ ). Secondary resistance:  $5...7.2\ k\Omega$ . Test interference-suppression resistors, H.T. ignition cables and spark plugs.

Interference-suppression resistor in

Distributor rotor:  $1\ k\Omega$

Distributor domes:  $1\ k\Omega$  each

Spark-plug connector:  $5\ k\Omega$  each

Spark plugs:  $0\ k\Omega$

Ignition coil:  $1\ k\Omega$

Yes

Does throttle valve open fully?

no

Throttle cable, accelerator O.K.? Accelerator may stick due to floor mat etc. Adjust throttle cable. Check pressure point for "kickdown".

Yes

Continued on K 5/K 6



High-voltage distributor

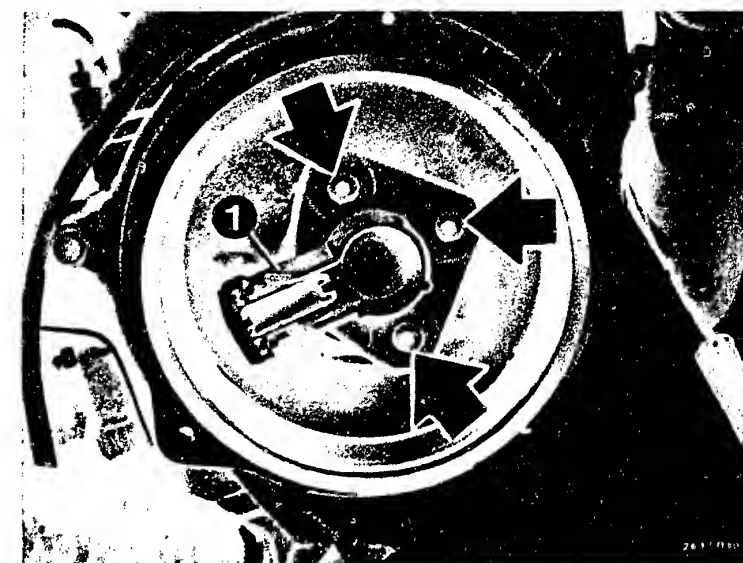
1 to 6 = cylinder numbers

ZS = High-tension lead to ignition coil

7 = Radiator cover

1 = Distributor rotor

Arrows = Fastening screws



K3

No maximum engine power

BMW 6 and 7 series with elec. trans.



K4

No maximum engine power

BMW 6 and 7 series with elec. trans.



No maximum engine power / top speed not reached (continued)

Yes

Air-flow sensor O.K.?

No

Testing: Open air-flow sensor flap by hand. It must be possible to open the air-flow sensor flap with uniform ease from its fully close position to its fully open position. When released, the flap must close completely by itself. When the air-flow sensor flap is opened it must not catch at any point. Watch for any indications of abrasion or rubbing. Clean air-flow sensor if the inside is very dirty and rub out with a lint-free cloth. If there are any signs of abrasion or rubbing, replace the air-flow sensor.

Yes

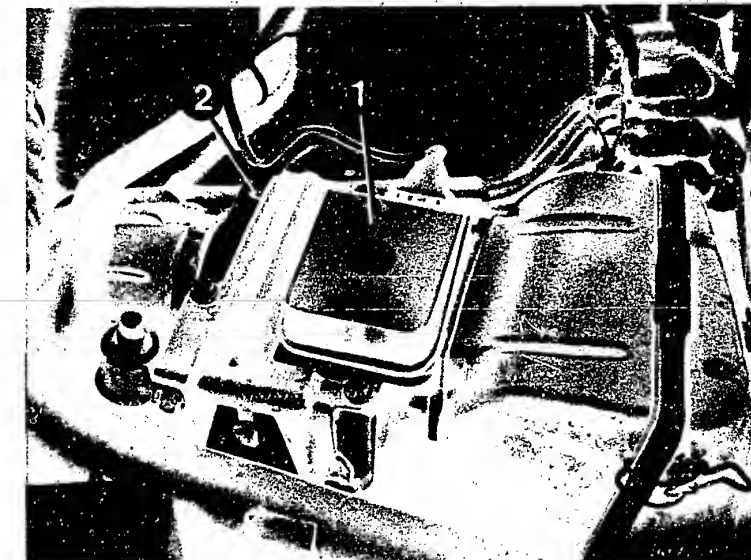
Air intake clear?

No

● Air filter clogged.

Yes

Continued on K7/K8



1 = Air-flow sensor with NTC I  
2 = Idle-mixture-adjusting screw

**K5**

No maximum engine power  
BMW 6 and 7 series with elec. trans.



**K6**

No maximum engine power  
BMW 6 and 7 series with elec. trans.



No maximum engine power/top speed cannot be reached (continued)

Yes

Fuel delivery O.K.?

No

Measure fuel delivery:

For testing, undo junction between fuel return hose (from pressure regulator) and fuel return line (to fuel tank). Extend hose if necessary and lead into a 5 l vessel with graduated scale. Build up fuel pressure: on universal test adapter, set program switch "V" to 17. Switch on ignition and press button T 3.

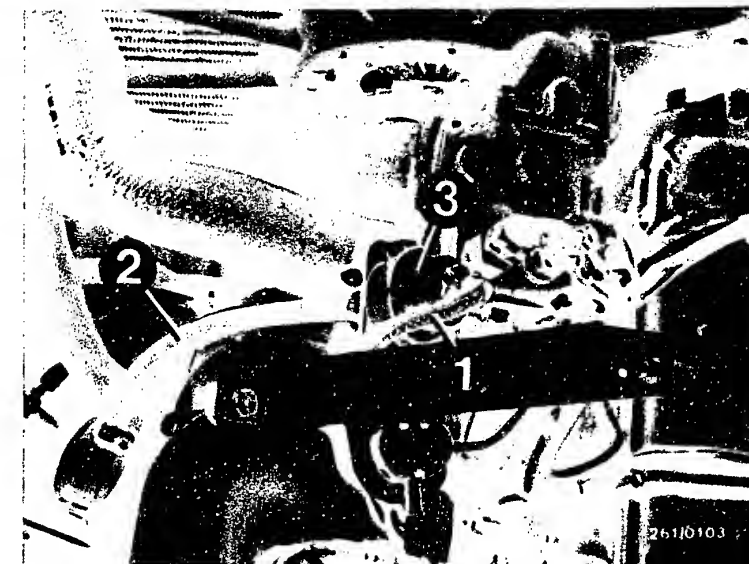
Test specification: min. 1050 cm<sup>3</sup>/30 s

Remedy if test specification not reached:

- Fuel filter clogged → replace.
- Voltage at fuel pump plugs, with engine running, min. 12 V. If not, clean contacts. Possibly eliminate poor ground connection. Replace leads.
- Check pre-supply pump.  
Listen: Remove connector from electric fuel pump. Build up fuel pressure: on universal test adapter, set program switch "V" to position 17. Switch on ignition and press button T 3. Pre-supply pump must operate. If not, check connecting leads and, if necessary, replace pre-supply pump.
- Fuel-pressure regulator defective → replace.
- Fuel pump delivery too low → replace fuel pump.
- Strainer in tank clogged? Corrosion in tank?

Yes

Continued on K9/K10



1 = Vacuum hose  
2 = Fuel return line  
3 = Pressure regulator

1 = Fuel delivery line to electric fuel pump  
2 = Fuel return line  
Arrows = Connector 2-pin pre-supply pump, 3-pin immersion-tube sensor



**K7**

No maximum engine power  
BMW 6 and 7 series with elec. trans.



**K8**

No maximum engine power  
BMW 6 and 7 series with elec. trans.



No maximum engine power/top speed cannot be reached (continued)

Yes

Fuel pressure at full load O.K.?

No

Yes

Mount pressure gauge on fuel-distribution pipe (delivery line).

Caution:

Catch any escaping fuel.

Danger of fire with hot engine and electric sparks

Let engine idle:

Fuel-pump pressure approx. 2.5 bar (2.0 bar)\*

Pull off air hose to intake manifold at pressure regulator:

Fuel-pump pressure: 2.8 ... 3.2 bar  
(2.3 ... 2.7 bar)\* (Reading must not fluctuate).

Re-connect air hose.

745i: Check fuel pressure at nominal speed and nominal output on chassis dynamometer:

At full load, fuel pressure rises to approx. 3.1 bar

Charge-air pressure at 4000 ... 4500min<sup>-1</sup> between 0.5 and 0.6 bar.

Trouble-shooting:

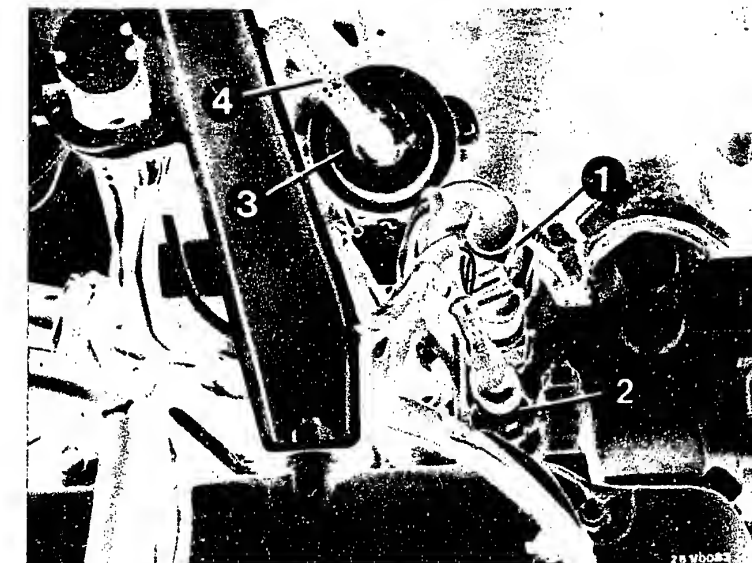
- Fuel filter clogged → replace.
- Voltage at fuel pump plugs, with engine running, min. 12 V. If not, clean contacts; possibly eliminate poor ground connection, replace leads.

\* Values for 745i

Yes

Continued on K13/K14

Continued on K11/K12



3 = Pressure regulator

4 = Air hose

1 = Electric fuel pump

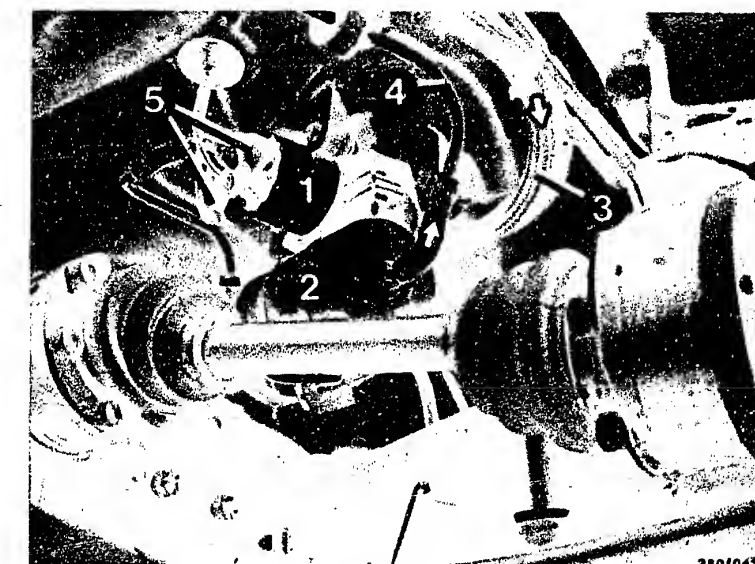
2 = Fuel filter

3 = Fuel intake line

4 = Fuel delivery line

5 = Fuel pump plug

Arrow = Direction of fuel flow



**K9**

No maximum engine power

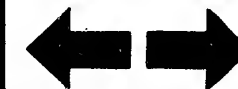
BMW 6 and 7 series with elec. trans.



**K10**

No maximum engine power

BMW 6 and 7 series with elec. trans.



No maximum engine power/top speed cannot be reached (continued)

Trouble-shooting (continued)

- Check pre-supply pump.  
Check by listening:  
Remove connector from electric fuel pump. Switch on fuel pump with test adapter, test step 36. Pre-supply pump must operate. If not, check connecting leads and, if necessary, replace pre-supply pump.
- Fuel pressure regulator defective → replace.
- Fuel pump delivery too low → replace fuel pump.
- Strainer in tank clogged? Corrosion in tank?
- 745i: Charge-air pressure too low:  
Air-carrying parts leaking, bypass air valve leaking, wastegate not closing, shaft in turbo-charger broken.
- Charge-air pressure too high:  
Control line clogged, control line leaking, diaphragm of wastegate broken and wastegate sticking (not opening).  
Solenoid-operated valve in control line defective or incorrectly energized. Check the knock-control per special SIS microcard.

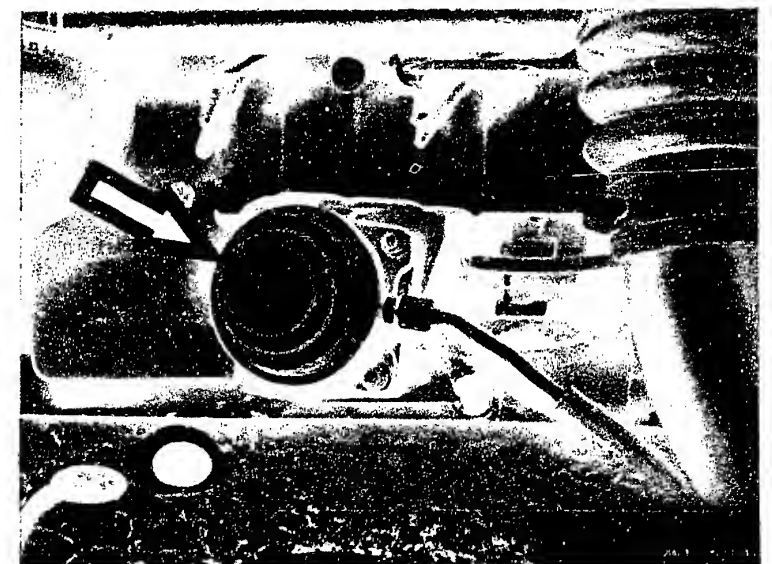
Yes

Continued on K13/K14



Installation position of pre-supply pump under mat in luggage compartment.  
1 = Fuel delivery line to electric fuel pump  
2 = Fuel return line  
Arrows = Connectors 2-pin pre-supply pump, 3-pin immersion-tube sensor

Arrow = Wastegate



**K11**

No maximum engine power  
BMW 6 and 7 series with elec. trans.



**K12**

No maximum engine power  
BMW 6 and 7 series with elec. trans.





No maximum engine power / top speed not reached (continued)

Yes

Are all hose lines and electric leads securely attached?  
Visual examination.  
Is the air-intake system leak-tight?

no

Check whether the hoses of the air-intake system and of the fuel line system are correctly attached, not kinked or damaged.  
Replace hoses if necessary. Eliminate leaks by means of new seals or by retightening the connecting screws.  
Checking for leaks: Seal off exhaust tail pipe.  
Remove air-filter element and seal off air-flow sensor duct.  
Unscrew hose to auxiliary-air device at pipe section and blow air (approx. 0.3 bar gauge pressure) into the pipe section with compressed-air gun. Seal off auxiliary-air device connection. Open throttle valve all the way. Brush or spray on leak-detector spray or soapy water at all sealing joints.  
Bubbles or foam indicate leakage.  
Check electrical contacts for loose contacts.

Yes

Testing completed for customer complaint

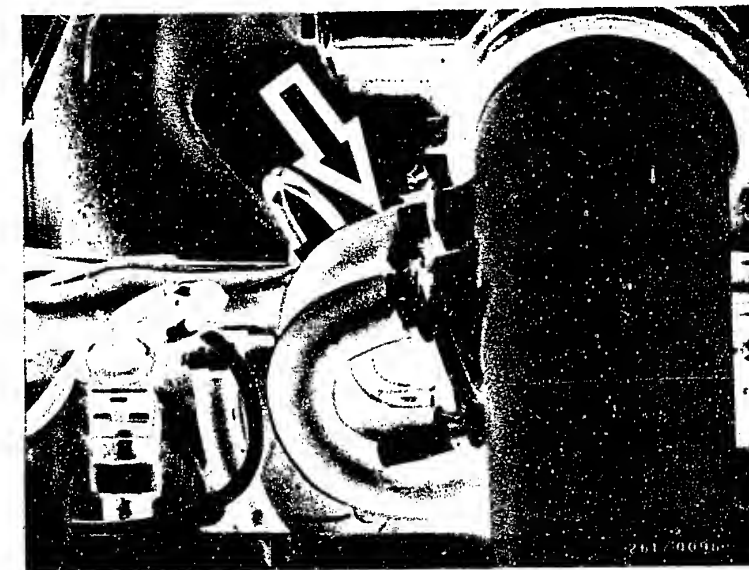
"No maximum engine power".

Customer complaint remedied?

no

Further possibilities:

- Customer complaint incorrectly diagnosed (see Coordinates B3...B10). If the fault has not been detected by "direct trouble-shooting", see "detailed trouble-shooting" (Coordinate B3/B4).
- Engine not mechanically O.K. (Compression, valve setting, valve timing, worn camshaft).
- Knock control not O.K.  
Testing per special SIS microcard.



Arrow = Hose to auxiliary-air device

**K13**

No maximum engine power

BMW 6 and 7 series with elec. trans.



**K14**

No maximum engine power

BMW 6 and 7 series with elec. trans.





## Trouble-shooting program according to customer complaints

### How to use the following trouble-shooting program

The program is divided into 3 rows of boxes:

1. The left-hand row contains the questions on the tests.
2. The middle row contains descriptions of the testing and adjustment operations on the components.
3. The right-hand row contains the illustrations belonging to the text and explains the illustrations.

If the questions can be answered conclusively with "yes" without testing, proceed to the next question below.

If, on the other hand, the answer to the question is "no", and you suspect a fault, branch to the middle row of boxes and carry out the tests given there.

When you have finished testing continue trouble-shooting at the point at which you branched off.

CO adjustment at idle too low or too high

Yes

Engine mechanically O.K.?

No

Remedy fault on engine.

Yes

Test with universal test  
adapter already performed?

No

For testing see Coordinates B11 - F7.

Yes

Continued on K17/K18

**K15**

CO adjustment

BMW 6 and 7 series with elec. trans.



**K16**

CO adjustment

BMW 6 and 7 series with elec. trans.



# CO adjustment at idle too low or too high (continued)

Yes

Check secondary pattern of all cylinders.  
Secondary pattern O.K.?

No

Check ignition coil and high-voltage section; distributor cap oil-fouled outside and inside? (Unscrew distributor rotor and check camshaft seal).

Note:

The distributor cap is fastened with 3 screws. To remove the distributor cap, it is necessary to remove the radiator cover.

When plugging on the H.T. ignition cables, pay attention to the cylinder numbers. Do not forget the cap and screening cover.

Check ignition coil primary for continuity (approx.  $0\ \Omega$ ). Secondary resistance:  $5...7.2\ k\Omega$ . Test interference-suppression resistors, H.T. ignition cables and spark plugs.

Interference-suppression resistor in

Distributor rotor:	$1\ k\Omega$
Distributor domes:	$1\ k\Omega$ each
Spark-plug connector:	$5\ k\Omega$ each
Spark plugs:	$0\ k\Omega$
Ignition coil:	$1\ k\Omega$

Yes

Air-flow sensor O.K.?

No

Testing: Open air-flow sensor flap by hand. It must be possible to open the air-flow sensor flap with uniform ease from its fully closed position to its fully open position. When released, the flap must close completely by itself. When the air-flow sensor flap is opened it must not catch at any point. Watch for any indications of abrasion or rubbing. Clean air-flow sensor if the inside is very dirty and rub out with a lint-free cloth. If there are any signs of abrasion or rubbing, replace the air-flow sensor.

Yes

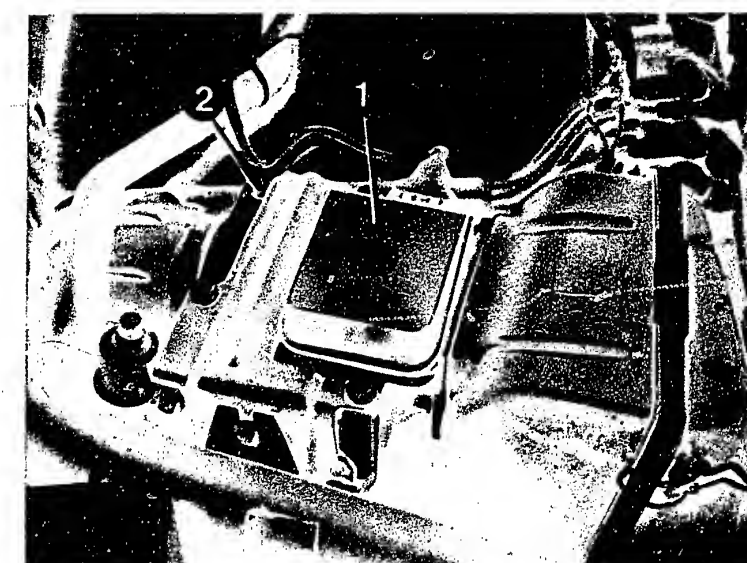
Continued on K19/K20



## High-voltage distributor

- 1 to 6 = cylinder numbers
- ZS = High-tension lead to ignition coil
- 7 = Radiator cover

- 1 = Air-flow sensor with NTC I
- 2 = Idle-mixture-adjusting screw



K17

CO adjustment

BMW 6 and 7 series with elec. trans.



K18

CO adjustment

BMW 6 and 7 series with elec. trans.



CO adjustment at idle too low or too high (continued)

Yes

Start valve O.K.?  
(Leak test)

No

Testing the start valve for leaks:

1. When installed

Pinch off fuel delivery line to start valve. If CO concentration then O.K., replace start valve.

2. When removed

Remove start valve (caution - fire hazard!). Fuel line and electric lead remain connected (place collector vessel under start valve).

Build up fuel pressure.

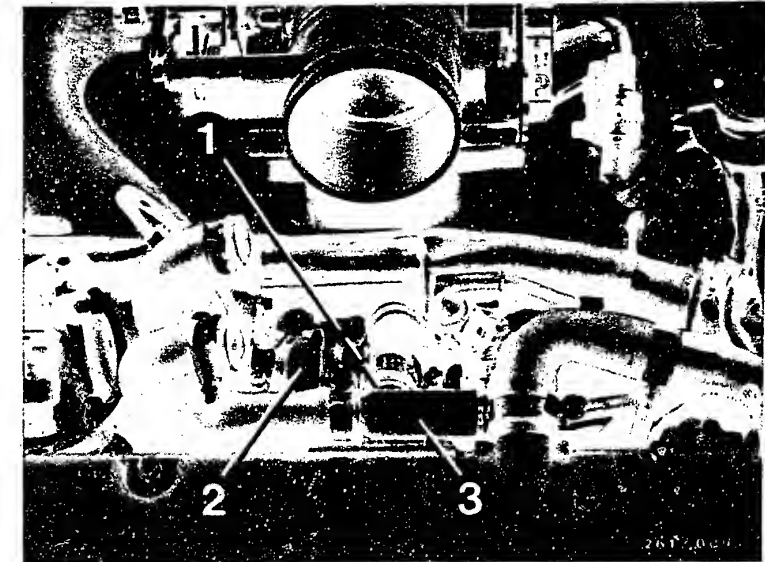
On the universal test adapter, set program switch "V" to position 17.

Switch on ignition and press button T 3.

Test specification: within one minute max. 1 drop may form at the mouth of the valve.

Yes

Continued on K21/K22

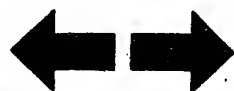


- 1 = Start valve
- 2 = Auxiliary-air device
- 3 = Idle-speed-adjusting screw

**K19**

CO adjustment

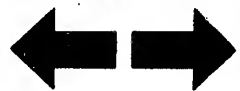
BMW 6 and 7 series with elec. trans.



**K20**

CO adjustment

BMW 6 and 7 series with elec. trans.



CO adjustment at idle too low or too high (continued)

Yes

Are all hose lines and electric leads securely attached?  
Visual examination.  
Is the air-intake system leak-tight?

no

Check whether hoses of air-intake system and of fuel line system are securely attached, not kinked or damaged. If necessary, replace hoses. Eliminate leaks with new seals or by re-tightening the connecting screws.

Checking for leaks: Seal off exhaust tail pipe. Remove air-filter element and seal off air-flow sensor duct.

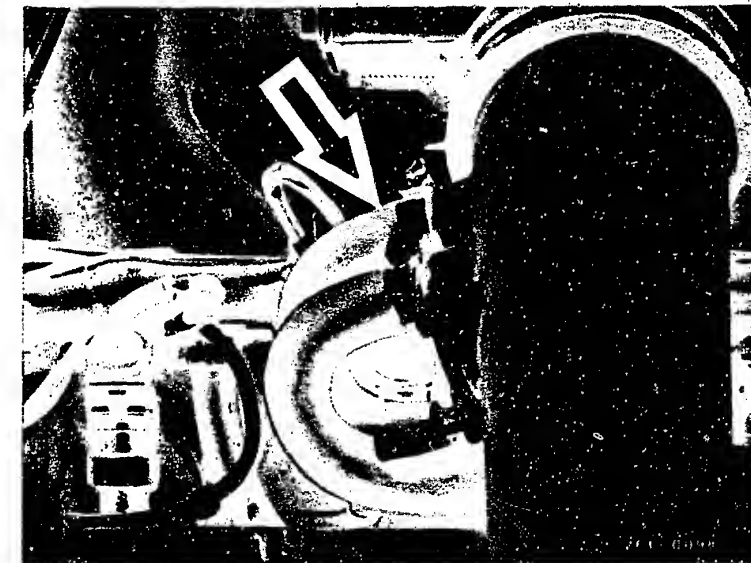
Unscrew hose to auxiliary-air device at pipe section and blow air (approx. 0.3 bar gauge pressure) into the pipe section with compressed-air gun. Seal off auxiliary-air device connection. Open throttle valve all the way. Brush or spray on leak-detector spray or soapy water at all sealing joints.

Bubbles or foam indicate leakage.

Check electrical contacts for loose contacts.

Yes

Continued on K23/K24



Arrow = Hose to auxiliary-air device

**K21**

CO adjustment

BMW 6 and 7 series with elec. trans.



**K22**

CO adjustment

BMW 6 and 7 series with elec. trans.



# CO adjustment at idle too low or too high (continued)

Yes

Exhaust-gas test with CO analyzer with engine at operating temperature.

Nominal value:  
1.0 ... 1.5 vol. %CO

S/CH/AUS:  
0.6 ... 1.0 vol. %CO

Japan:  
0.45 ... 0.65 vol. %CO  
(Measurement before cat. converter)

No

Prerequisite: idle speed  
750 ... 850 min<sup>-1</sup> or 800 ... 900 min<sup>-1</sup>

Remove plastic plug in air-flow sensor.

- CO concentration too low:  
Turn bypass screw (hexagon-socket head AF5) in air-flow sensor step-by-step in a clockwise direction (to the right).
- CO concentration too high:  
Turn bypass screw (hexagon-socket head AF5) in air-flow sensor step-by-step in a counterclockwise direction (to the left).

After completing adjustment, use new plug (red).

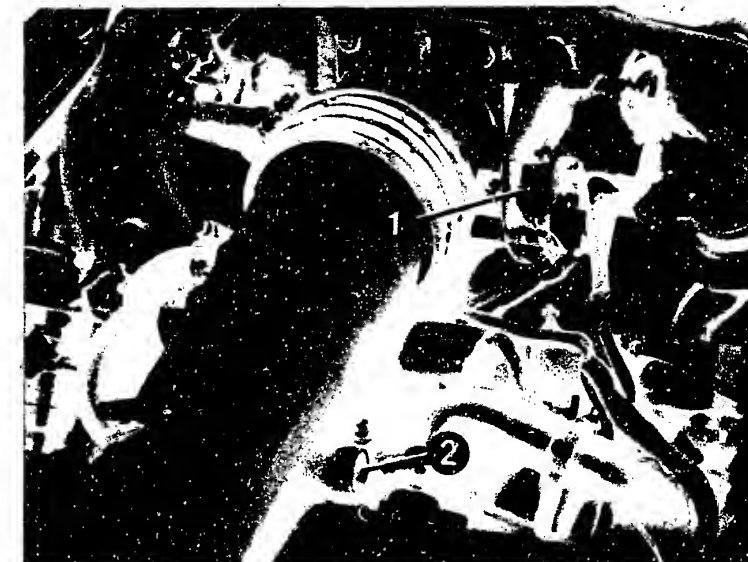
No

Testing completed for customer complaint  
"CO adjustment at idle too low or too high"

Customer complaint remedied?

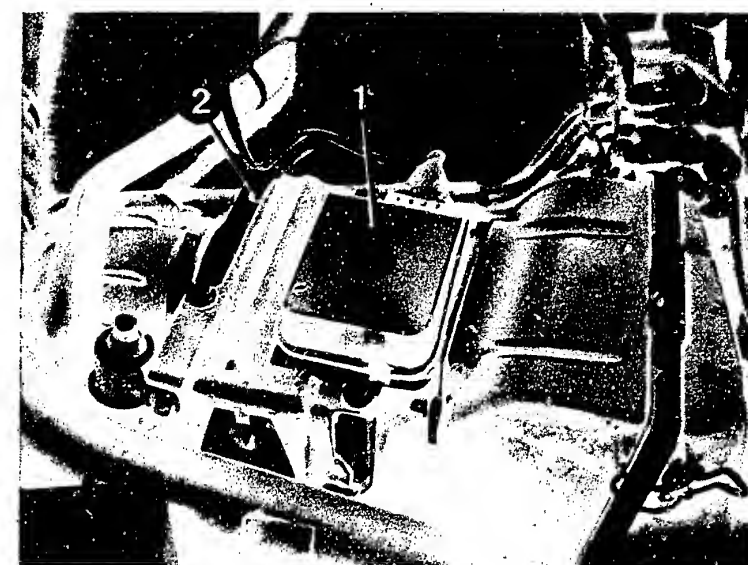
Further possibilities:

- Customer complaint incorrectly diagnosed (see Coordinates B3...B10). If the fault has not been detected by "direct trouble-shooting", see "detailed trouble-shooting" (Coordinates B3/B4).
- Engine not mechanically O.K. (Compression, valve setting, valve timing, worn camshaft).



1 = Microswitch  
2 = Idle-speed-adjusting screw

1 = Air-flow sensor with NTC I  
2 = Idle-mixture-adjusting screw



**K23**

CO adjustment.

BMW 6 and 7 series with elec. trans.



**K24**

CO adjustment

BMW 6 and 7 series with elec. trans.



# After-sales Service

## Motor Vehicle Service Information

Only for use within the Bosch organization. Not to be communicated to any third party.

Electrical equipment

CORRECTION OF THE IGNITION POINT AND ADDITIONAL  
MIXTURE ADAPTATION WITH MOTRONIC CONTROL UNITS -  
WITH THE AID OF THE PC-BOARD SWITCH AND  
ADJUSTMENT PIN KDMT 0002

VDI-I-Gen. 058 En  
4.1983

Since August 1980 Bosch has been supplying Motronic control units containing a PC-board switch which is accessible from outside.

The introduction of this switch means that workshop personnel have the possibility of changing the ignition point and are also provided with an additional mixture adaptation facility. The values for mixture and ignition correction/adaptation are held within relatively tight limits. A correction may only be undertaken when (1) the fuel quality is not sufficient or when (2) the mixture must be adapted despite the fact that all other known measures have been tried (according to after-sales service instructions). Unnecessary adjustment to the switch though, leads to poor driveability, and particularly to "search" during overrun or to increased fuel consumption, in some cases even to engine damage. The vehicle-related Service Information bulletins should at all costs be carefully observed. This Service Information bulletin also gives exact details on the adjustment ranges of the switch positions.

### Ignition-point correction

The quality of the gasoline in various countries does not always comply with the standard required for this engine. It is therefore recommended that for journeys in countries where the premium gasoline (super-grade) octane number (research method) is below 98, a correction be carried out to the ignition point by means of the PC-board switch. This applies especially to the Porsche 944. Details can be found in the vehicle-related Service Information bulletin.

The correction of the ignition point must be made in the "retard" direction and applies across the whole of the ignition point map. The correction prevents the "ping" and "knock" which are dangerous for the engine.

The adjustment of the ignition point leads, inevitably, to an increase in fuel consumption.

For this reason the original setting should be adjusted again after the journey for which such an adjustment was made.

**BOSCH**

**N1**

Motor Vehicle Service Information

BMW 6 and 7 series with elec. trans.





## Mixture adjustment

As is already known, the CO-adjustment takes place through the idle-mixture screw in the air-flow sensor. This is still the case and no change has taken place here. The PC-board switch though, apart from changing the ignition point also provides an additional possibility of adjusting the mixture. The PC-board switch is operative over the complete range as opposed to the bypass in the air-flow sensor which is only effective at idle and lower part-load range. For this reason, a change in the mixture using this switch is only justified when it is absolutely certain that defects are not present on the engine (i.e. valves, intake system, exhaust), the fuel-injection system or the ignition.

The Motronic is checked using the after-sales service instructions which have already been issued.

Further details as well as a table with switch positions and relevant operating range can be found in the vehicle-related Service Information bulletin.

### Special adjustment pin KDMT 0002 for the PC-board switch (Fig. 2)

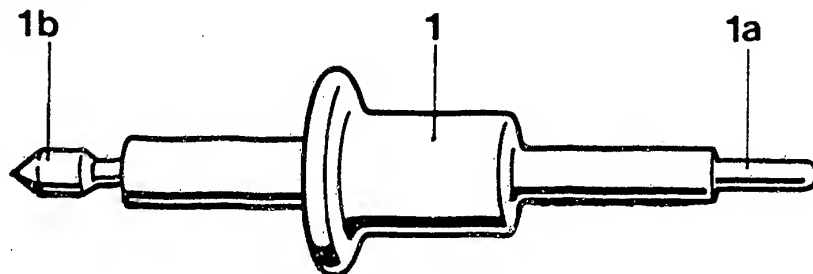
Bosch has developed a special tool for the correct and safe adjustment of the PC-board switch. The tool is made of plastic and prevents damage to the costly control unit when the cover is pressed in and when the switch is pushed up against the stops. When too much force is used, the triangular end of the pin breaks off.

NEVER use a screwdriver to adjust the PC-board switch.

The special tool KDMT 0002 is available through the usual channels or directly from KH/VKD 4. Subscribers to the toolprogram receive it automatically.

Please note: Tool KDMT 0002 replaces the existing tool KDMT 0001.  
KDMT 0002 has a wider range of uses (see below)

Fig. 1



- 1 = Adjustment pin
- 1 a = Bore (triangular polygon) for adjusting the PC-board switch
- 1 b = Tool part for removing the cover (only for control units with metal housing)

### Adjusting the PC-board switch

Remove the control unit (see after-sales service instructions)

At the moment there are two kinds of control unit: with cast frame (former design, Fig. 2) and with metal housing (new design, Fig. 3).



With control units with cast frame (Fig. 2) proceed as follows:

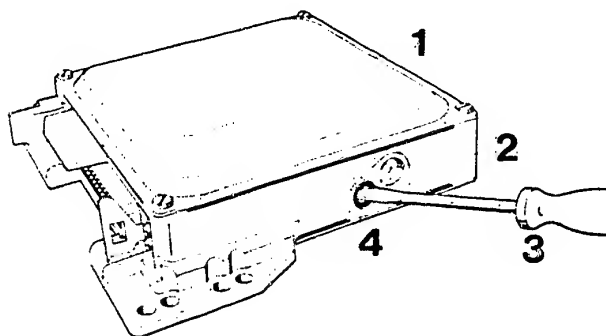
Using a screwdriver, carefully remove the cover.

In order to do this, insert a wide-bladed screwdriver into the side at an angle, carefully push through the cover and remove it (Fig. 2). Take care that the PC-board is not knocked or otherwise contacted in the process.

The hole (triangular polygon) is now free for insertion of the special tool KDMT 0002.

Fig 2

- 1 = Control unit with cast frame
- 2 = Diode
- 3 = Screwdriver
- 4 = Cover for PC-board switch

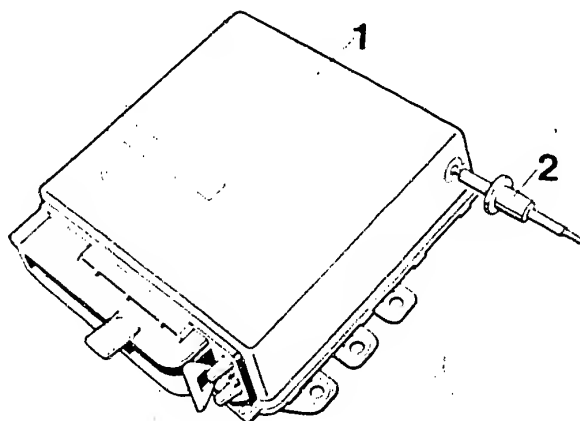


With control units with metal housing (Fig. 3) the cover should be removed as follows:

The point of the adjusting pin intended for removing the cover (Fig. 1, no. 1b) should be inserted fully into the cover (Fig. 3). This loosens the locking device of the cover and enables the latter to be removed. Now the hole is ready (triangular polygon) is ready to receive the bore of KDMT 0002.

Fig. 3

- 1 = Control unit with metal housing
- 2 = Adjusting pin KDMT 0002



The following applies for both kinds of control unit:

Due to the danger of destroying the control unit, metallic objects or screwdrivers are NOT to be used, only the special tool KDMT 0002.

Using a minimum of force, turn the PC-board switch to its left-hand stop (Fig. 4). If already adjusted, count the number of "click" positions and note them down.

Select the new switch position according to the vehicle-related table.

Start counting the "click" positions from the left. Take into account the fact that the switch has defined detent positions and intermediate positions are not possible.

Check that the setting is correct by using the CO-analyzer and by taking the vehicle on a test run.

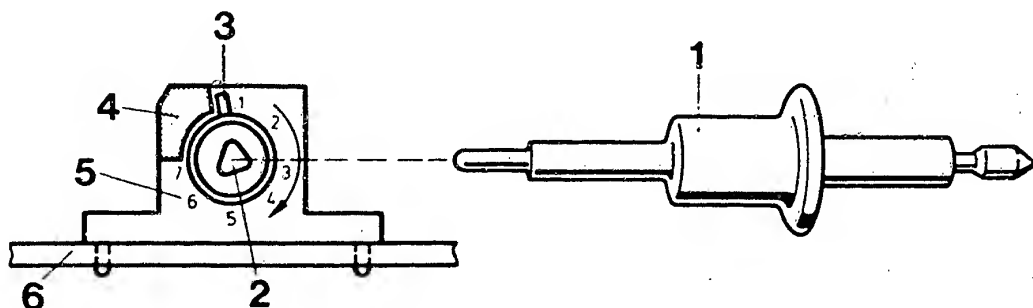
After the adjustment has been completed, a new cover (red) MUST be fitted in the hole in the control unit. This is important because it guarantees protection against humidity and prevents unauthorized tampering.

Part no. for cover (red) for control unit with cast frame: 1 280 508 012

Part no. for cover (red) for control unit with metal housing : 1 260 321 002

Please note: Black and blue covers are only fitted by Bosch or the vehicle manufacturer at their works.

Fig. 4



- 1 = Adjusting pin KDMT 0002
- 2 = Hole (triangular polygon)
- 3 = Basic position (left-hand stop)
- 4 = Stop
- 5 = Switch positions ("click" positions)
- 6 = PC-board



# After-sales Service

## Technical Bulletin

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13...39

VDT-I-261/102 En

6.1983

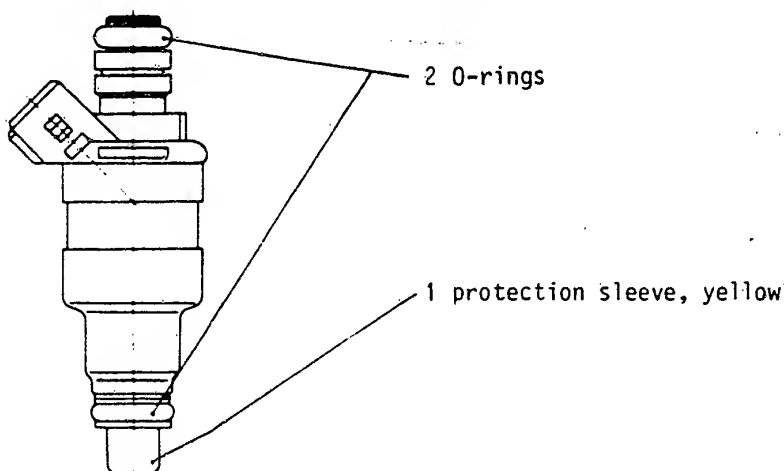
PARTS SET FOR SOLENOID-OPERATED INJECTION VALVES  
0 280 150 2..

Supersedes 8.1982 edition

AND PRESSURE REGULATORS 0 280 160 2..

A common parts set is available for the Motronic solenoid-operated injection valves and pressure regulators with the new method of connection.

Contents for 1 injection valve: ..



Contents for pressure regulator:  
1 O-ring  
1 supporting plate

Since the above-mentioned parts are subjected to extreme temperature stress, they should be exchanged for new parts whenever servicing is carried out.

"Unmetered air" sucked in through injection-valve seals which are not tight, is a frequent case for servicing.

The parts set has the part number 1 287 010 704 and will in future be listed in the service parts microfiche under solenoid-operated injection valves (see EE 00 under 0 280..).

Please direct questions and comments concerning the contents to our authorized representative in your country.

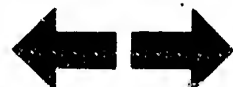
**BOSCH**

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**N5**

Technical Bulletin

BMW 6 and 7 series with elec. trans.



# Technical Bulletin

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28

PLUG CONNECTORS FOR  
JETRONIC COMPONENTS  
Parts sets

VDT-I-280/111 En

11.1984

(supersedes edition 11.1982)

Parts sets are available for replacement of Jetronic plug connectors. These consist of:

- Plug connector housing
- Protective cap (rubber sleeve)
- Contact springs

These parts are listed on microfiche EE...\*.

\* see microfiche EE00 under 0 280 ..

- Plug, black, 2-pin,  
parts set 1 287 013 002 cable connector in conjunction with socket, 2-pin
- Socket, black, 2-pin,  
parts set 1 287 013 001 for e.g.

Temperature sensor	0 280 130 0..
Auxiliary-air device	0 280 140 ..
Thermo-time switch	0 280 130 2..
Start valve	0 280 170 ..
Warm-up regulator	0 438 140 ..

- Socket, grey, 2-pin  
parts set 1 287 013 003 for:

Solenoid-operated injection valve	0 280 150 ..
--------------------------------------	--------------

**N6**

Technical Bulletin

BMW 6 and 7 series with elec. trans.



- Socket, black, 3-pin,  
parts set 1 237 000 039 for:  
Throttle-valve switch 0 280 120 ..
- Socket, black, 5-pin,  
parts set 1 287 013 006 for:  
Air-flow sensor 0 280 20. ..  
(LE version)
- Socket, black, 6-pin,  
parts set 1 287 013 004 for  
Air-flow sensor 0 280 200 ..
- Socket, black, 7-pin,  
parts set 1 287 013 005 for:  
Air-flow sensor 0 280 20. ..  
Air-mass sensor 0 280 211 ..
- Wiring-harness plug connector, black, 25-pin  
parts set 1 287 013 009 for:  
Control unit 0 280 0..
- Wiring-harness plug connector, black, 35-pin,  
parts set 1 287 013 008 for:  
Control unit 0 280 0..

The contact springs (minitimers) are also available separately under part no. 1 284 477 026.

The plug-connector housings are only available in the stated colours.

Responsible:

Robert Bosch GmbH

Division KH

Technical After-Sales Service (KH/VKD 2)

Please direct questions and comments concerning the contents to our authorized representative in your country.





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For direct trouble-shooting of a specific Motronic component, it is absolutely necessary to look up the component under the appropriate customer complaint.

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